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# FIELDIANA

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## Botany

NEW SERIES, NO. 18

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### FLORA COSTARICENSIS

William Burger, Editor

#### Family #200 Acanthaceae

L. H. Durkee

#### Family #201 Plantaginaceae

William Burger

December 31, 1986  
Publication 1372

PUBLISHED BY FIELD MUSEUM OF NATURAL HISTORY

Families of seed plants known or expected to occur in Costa Rica and adjacent areas, listed alphabetically and numbered according to the sequence of Engler's *Syllabus der Pflanzenfamilien*, edition 11, reworked by L. Diels (1936).

200	Acanthaceae	130	Elaeocarpaceae	137	Ochnaceae
136	Actinidiaceae	143	Elatinaceae	56	Olacaceae
67	Aizooaceae	172	Ericaceae	181	Oleaceae
11	Alismataceae	23	Eriocaulaceae	164	Onagraceae
64	Amaranthaceae	102	Erythroxylaceae	57	Opiliaceae
30	Amaryllidaceae	113	Euphorbiaceae	39	Orchidaceae
117	Anacardiaceae	96	Fabaceae, see Leguminosae	197	Orobanchaceae
77	Anonaceae	50	Fagaceae	98	Oxalidaceae
184	Apocynaceae	148	Flacourtiaceae	17	Palmae
119	Aquifoliaceae	82	Fumariaceae,	82	Papaveraceae
19	Araceae		see Papaveraceae	150	Passifloraceae
166	Araliaceae	45	Garryaceae	195	Pedaliaceae
4	Araucariaceae	183	Gentianaceae	66	Phytolaccaceae
59	Aristolochiaceae	99	Geraniaceae	5	Pinaceae
185	Asclepiadaceae	198	Gesneriaceae	41	Piperaceae
61	Balanophoraceae	7	Gnetaceae	171	Pyrolaceae
127	Balsaminaceae	15	Gramineae	201	Plantaginaceae
69	Basellaceae	142	Guttiferae	176	Plumbaginaceae
48	Batidaceae	29	Haemodoraceae	3	Podocarpaceae
153	Begoniaceae	165	Halorrhagaceae	54	Podo-stemonaceae
74	Berberidaceae	93	Hamamelidaceae	187	Polemoniaceae
49	Betulaceae	81	Hernandiaceae	111	Polygalaceae
194	Bignoniaceae	124	Hippocrastanaceae	62	Polygonaceae
145	Bixaceae	121	Hippocrateaceae	26	Pontederiaceae
133	Bombacaceae	101	Humiriaceae,	68	Portulacaceae
189	Boraginaceae		see Linaceae	9	Potamogetonaceae
24	Bromeliaceae	60a	Hydnoraceae	175	Primulaceae
91	Brunelliaceae	13	Hydrocharitaceae	55	Proteaceae
38	Burmanniaceae	188	Hydrophyllaceae	158	Punicaceae
106	Burseraceae	142	Hypericaceae,	140	Quiinaceae
12	Butomaceae		see Guttiferae	60b	Rafflesiaceae
115	Buxaceae	123	Icacinaceae	73	Ranunculaceae
154	Cactaceae	33	Iridaceae	86	Resedaceae
96	Caesalpiniaceae, see Leguminosae	47	Juglandaceae	128	Rhamnaceae
114	Callitrichaceae	27	Juncaceae	160	Rhizophoraceae
207	Campanulaceae	97	Krameriaceae	94	Rosaceae
36	Cannaceae	191	Labiateae	202	Rubiaceae
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203	Caprifoliaceae	80	Lauraceae	126	Sabiaceae
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206	Cucurbitaceae	96	Mimosaceae,	149	Turneraceae
92	Cunoniaceae		see Leguminosae	8	Typhaceae
6	Cupressaceae	79	Monimiaceae	51	Ulmaceae
1	Cycadaceae	170	Monotropaceae	167	Umbelliferae
18	Cyclanthaceae	52	Moraceae	53	Urticaceae
16	Cyperaceae	87	Moringaceae	204	Valerianaceae
118	Cyrillaceae	34	Musaceae	31	Velloziaceae
112	Dichapetalaceae	46	Myricaceae	190	Verbenaceae
135	Dilleniaceae	78	Myristicaceae	147	Violaceae
32	Dioscoreaceae	174	Myrsinaceae	129	Vitaceae
205	Dipsacaceae	162	Myrtaceae	110	Vochysiaceae
88	Droseraceae	10	Najadaceae	22	Xyridaceae
178	Ebenaceae	65	Nyctaginaceae	35	Zingiberaceae
156	Elaeagnaceae	71	Nymphagaceae	103	Zygophyllaceae

**FLORA COSTARICENSIS**  
**Family #200 Acanthaceae**  
**Family #201 Plantaginaceae**

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# FIELDIANA

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## Botany

NEW SERIES, NO. 18

### FLORA COSTARICENSIS

William Burger, Editor

### Family #200 Acanthaceae

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## Acknowledgments

This is the fifth issue of the Flora Costaricensis. The first dealt with Piperaceae (Fieldiana, Bot. 35, 1971). The second included families numbered 42 through 53, Chloranthaceae through Urticaceae (Fieldiana, Bot. 40, 1977). The third issue contained the Gramineae by Richard Pohl (Fieldiana, Bot., new series, No. 4, 1980). The fourth issue included families numbered 54 through 70, Podostemaceae through Caryophyllaceae (Fieldiana, Bot., new series, No. 13, 1983). We are especially grateful for the financial assistance of the National Science Foundation, which has aided this program for many years, both at Field Museum and in Costa Rican fieldwork. The project at Field Museum has been supported most recently by NSF grant DEB-8103184, through the Biological Research Resources Program. The staff and the facilities of the Museo Nacional de Costa Rica have been a central resource and most helpful to our work for more than two decades. This issue includes the large and attractive Acanthaceae family. We are especially fortunate to have the account of this

family prepared by Dr. Durkee, a specialist in the family who has spent considerable time in Costa Rica and earlier published an account of the Acanthaceae for the Flora of Panama.

Technical assistance and fieldwork for Durkee have been financed by grants from Grinnell College and the Associated Colleges of the Midwest. Work on the Acanthaceae was supported by loans from the following herbaria: Museo Nacional de Costa Rica, Duke University, Field Museum of Natural History, Missouri Botanical Garden, New York Botanical Garden, and the Museum of Natural History, Smithsonian Institution. Robin Chazdon and Sarah Dewey provided able technical assistance; Susan Durkee (SD), Laurie Engle, Kelly Hanick (KH), Lyla Kimura (LK), Kathleen Neff (KBN), Christopher Rasmussen (CAR), and Anthony Sheeder (TS) were the illustrators for the Acanthaceae. All of these individuals were undergraduates at Grinnell College during the time of their work.

# FLORA COSTARICENSIS

## Family #200 Acanthaceae

## Family #201 Plantaginaceae

### ACANTHACEAE

By L. H. Durkee

REFERENCES—C. E. B. Bremekamp, The delimitation of the Acanthaceae. Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. C. 56: 533–546. 1953. C. E. B. Bremekamp, Delimitation and subdivision of the Acanthaceae. Bull. Bot. Surv. India 7: 21–30. 1965. A. Cronquist, Acanthaceae, pp. 963–966. In An Integrated System of Classification of Flowering Plants. 1981. L. H. Durkee, Acanthaceae. In Flora of Panama. Ann. Missouri Bot. Gard. 65: 156–283. 1978. E. C. Leonard, Acanthaceae. In P. C. Standley, Flora of Costa Rica. Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1188–1263. 1938. E. C. Leonard, The Acanthaceae of Colombia. Contr. U.S. Natl. Herb. 31. 1951–1958. G. Lindau, Acanthaceae. In A. Engler and G. Prantl (eds.), Nat. Pflanzenfam. 4(3b): 274–354. 1895.

Herbaceous to suffrutescent plants, some twining, less often shrubs, rarely trees. Leaves simple, opposite (except *Elytraria* of the subfamily Nelsoniodiae), exstipulate, often with cystoliths on the upper surfaces of laminae (most evident in dried specimens). Flowers irregular to nearly regular, perfect, borne in spikes, racemes, panicles, cymes, or singly and often subtended by a conspicuous bract with 2 bracteoles; calyx synsepalous at least basally, persistent, the segments (3, 4) 5(–16); the corolla gamopetalous, the limb 5-lobed or 2-lipped, rarely 1-lipped; stamens adnate to the corolla tube, 4 and didynamous or 2 only, staminodes often present in flowers with 2 stamens; rarely all 5 stamens fully developed (none in ours); the anther cells 2 or 1, longitudinally dehiscent, the pollen sacs juxtaposed or sometimes superposed; ovary 2-celled, superior, 2–10 ovules in each cell, the style filiform, simple, the stigmas 1 or 2. Fruit a loculicidal capsule (except *Mendoncia* with its drupaceous fruits), often explosively dehiscent; seeds usually flattened, mostly borne on hook-shaped funicles, some-

times on papilliform funicles, the testa smooth or roughened, often mucilaginous when wetted.

The family Acanthaceae includes about 250 genera and 2,500 species, widespread in both New and Old World Tropics, with only a few species occurring in warm temperate regions. The family is divided into four subfamilies according to Lindau. More recent considerations have raised each of the subfamilies Mendoncioideae, Nelsonioideae, and Thunbergioideae to family ranks. I am in agreement with Cronquist who recognizes the Mendonciaceae, but who feels that the Nelsonioideae and Thunbergioideae represent stages along the way between the Scrophulariaceae and the Acanthoideae, the fourth subfamily of Lindau. While they have clear affinity with the Acanthoideae, they are anomalous with either family, but insufficiently distinct to warrant separate status. Furthermore, Cronquist does not feel that the connecting forms are sufficiently numerous to warrant uniting the Acanthaceae and the Scrophulariaceae. The subfamily Mendoncioideae is included in this treatment as a matter of convenience since it follows traditional usage.

The Acanthaceae can be recognized by the prominent cystoliths appearing with magnification as small, cylindrical concretions or short, raised lines on the upper surface of the dried leaves, younger stems, the branches of the inflorescence, and the calyx. Genera lacking these are few and have other exceptional features such as the fruit. The genus *Mendoncia* is unique, with a drupaceous fruit, for example. The only genera lacking

cystoliths and having the more typical capsular fruit with hooklike funicles are the genera *Aphelandra* and *Megaskepasma*. Seeds are frequently ejected forcefully by the hook-shaped funicles when the mature capsules are moistened by rainfall. In opened or dehisced capsules, the funicles can be seen as hook-shaped projections. Many species of the family also have imbricate bracts subtending the flowers. These bracts may be green, yellow, bright red, or orange.

While most genera of the family are restricted to either New or Old World Tropics, a few are found in both. These include *Justicia* and *Ruellia*, the largest genera in the family, with about 410 and 250 species, respectively. Typically, most of these species are found in the tropics and subtropics, with a few extending into temperate areas.

The major economic importance of the family is horticultural. Cultivation is often restricted to greenhouses, however, since in spite of attractive foliage and flowers, they are difficult to grow. *Justicia brandegeana*, the shrimp plant, with its showy spikes of reddish bracts is perhaps the best known in the United States. Seeds of *Thunbergia alata*, the clock vine or black-eyed susan, are frequently sold in gardening stores in the United States, and in the tropics several other species are grown for their attractive foliage and flowers. Many other genera are cultivated; these include: *Acanthus*, *Aphelandra*, *Crossandra*, *Eranthemum*, *Fittonia*, *Graptophyllum*, *Hypoestes*, *Pachystachys*, *Ruellia*, *Sanchezia*, and *Strobilanthes*.

The following summary characterizes each of the four subfamilies as recognized here and indicates the Costa Rican genera belonging to each.

#### Conspectus of the Subfamilies and Genera in Costa Rica

SUBFAMILY I. ACANTHOIDEAE—Cylindrical silicified cystoliths commonly present in epidermal

cells of stems and leaves. These are best observed under magnification of dried specimens. They are sometimes mistaken for strigose hairs. Among the Costa Rican genera, *Aphelandra* and *Megaskepasma* lack cystoliths. Seeds borne on hooklike funicles in explosively dehiscent capsules. Most of the genera and species of the family are found in this subfamily: *Acanthus*, *Aphelandra*, *Asystasia*, *Barleria*, *Blechum*, *Bravaisia*, *Buceragenia*, *Carlowrightia*, *Chaetochlamys*, *Chaetothylax*, *Chamaeranthemum*, *Dicliptera*, *Dyschoriste*, *Graptophyllum*, *Habracanthus*, *Hansteinia*, *Henrya*, *Herpetacanthus*, *Hygrophila*, *Hypoestes*, *Justicia*, *Louteridium*, *Megaskepasma*, *Odontonema*, *Pokilacanthus*, *Pseuderanthemum*, *Razisea*, *Ruellia*, *Sanchezia*, *Spathacanthus*, *Streblacanthus*, *Teliostachya*, *Tetramerium*, *Tricanthera*.

SUBFAMILY II. MENDONCIOIDAE—Mostly high-climbing vines without cystoliths. Upper surfaces of laminae sometimes with stellate bases of the hairs. Flowers enclosed by two fairly conspicuous bracts that are at first connate; calyx reduced to an entire or low-lobed annulus. Fruit a drupe: *Mendoncia*.

SUBFAMILY III. NELSONIOIDAE—Herbs without cystoliths in stems or leaves. Leaves opposite or alternate. Inflorescences mostly in bracteate spikes. Flowers with a more or less equally five-parted calyx. Fruit a capsule with papilliform funicles: *Elytraria*, *Nelsonia*.

SUBFAMILY IV. THUNBERGIOIDAE—Vines or shrubs. Cystoliths lacking in stems and leaves. Flowers with an annular or toothed calyx; corollas usually conspicuous; stamens four with two-celled anthers. Fruit a beaked capsule with pulvinate funicles. The genera of this subfamily are all of Paleotropical origin, and Neotropical species are cultivated or escaped: *Thunbergia*.

**ACANTHUS  
mollis**

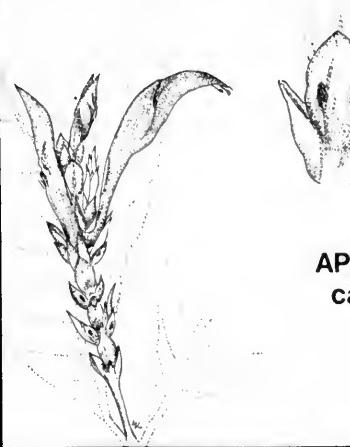


**APHELANDRA  
aurantiaca  
var. aurantiaca**

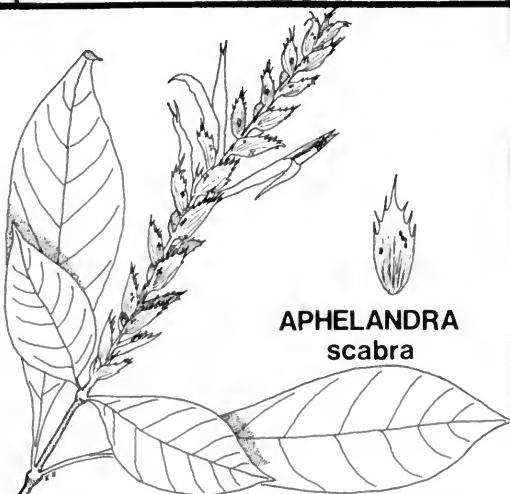


**APHELANDRA  
aurantiaca  
var. stenophylla**

5 cm



**APHELANDRA  
campanensis**



**APHELANDRA  
scabra**

**APHELANDRA  
dolichantha**



FIG. 1. Acanthaceae: species of *Acanthus* and *Aphelandra* (in part) in Costa Rica. The 5-cm scale refers to foliage and inflorescences, but note that *Acanthus mollis* is at a different scale.

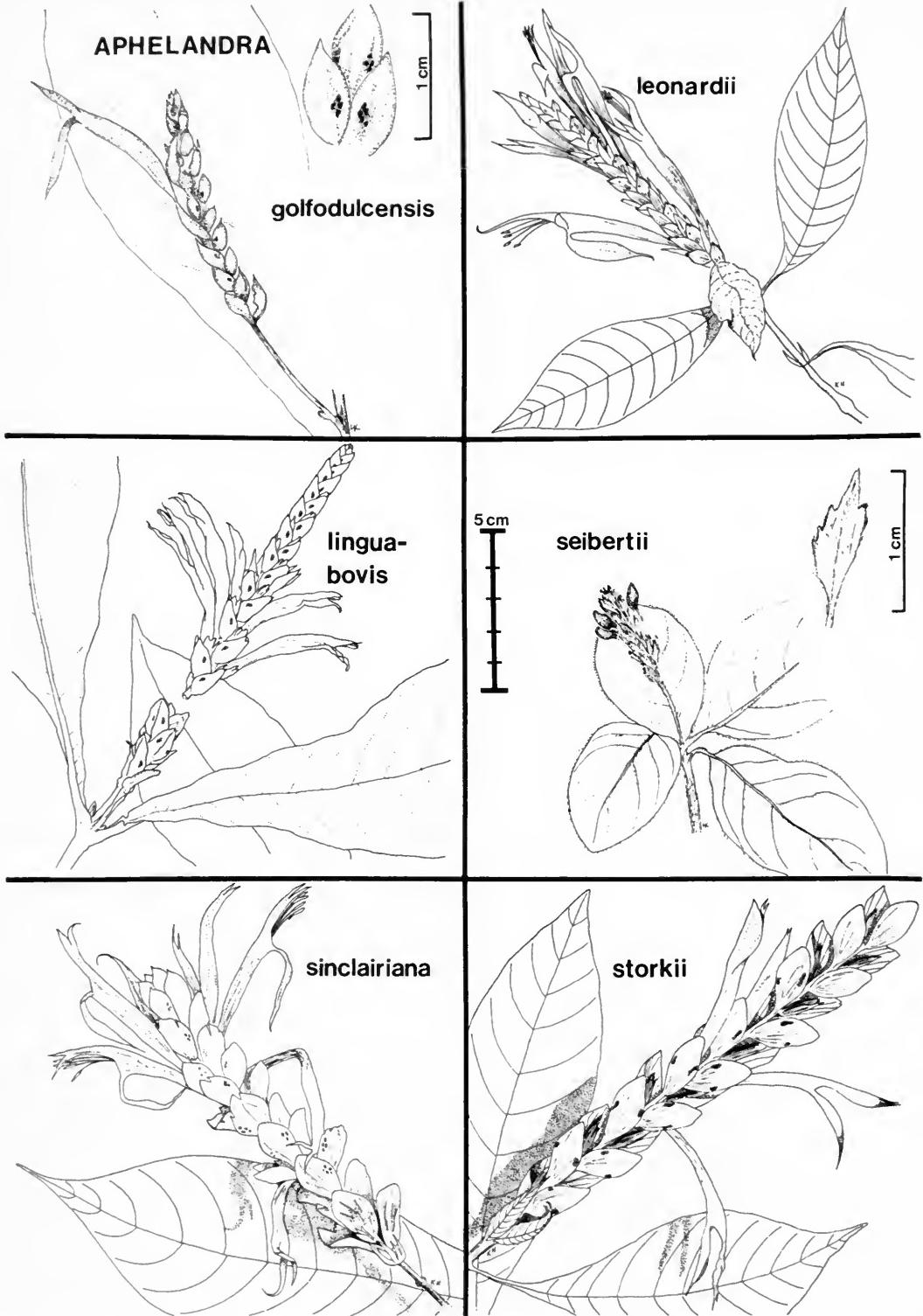


FIG. 2. Acanthaceae: species of *Aphelandra* (second part) in Costa Rica.

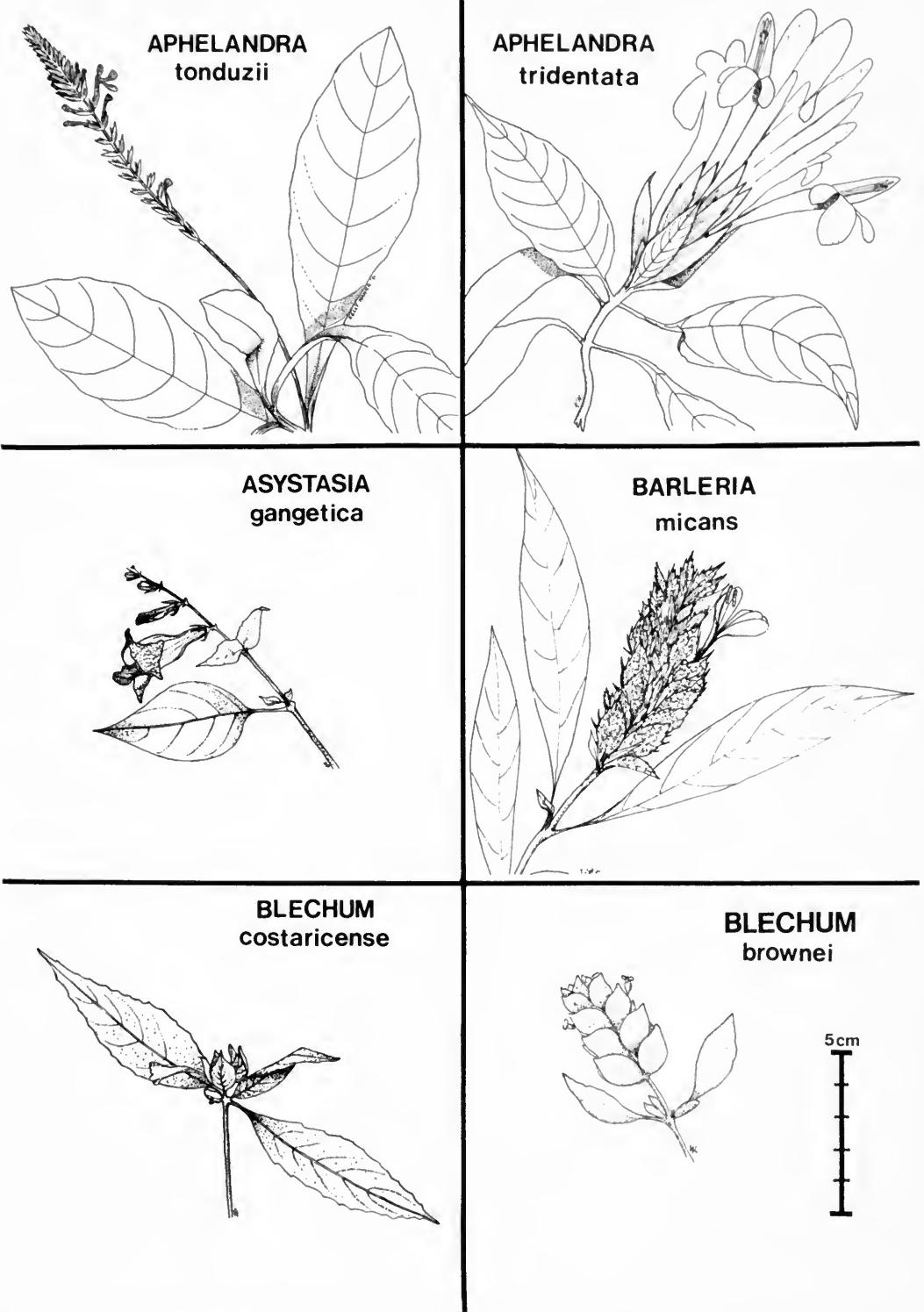
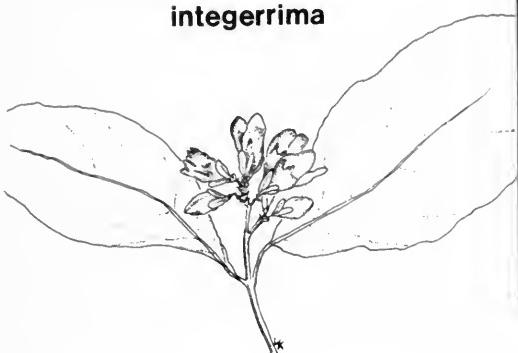
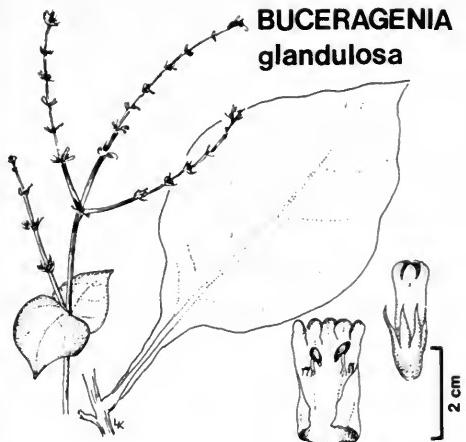


FIG. 3. Acanthaceae: species of *Aphelandra* (concluding part), *Asystasia*, *Barleria*, and *Blechum* in Costa Rica.

**BRAVAISIA**  
*integerrima*



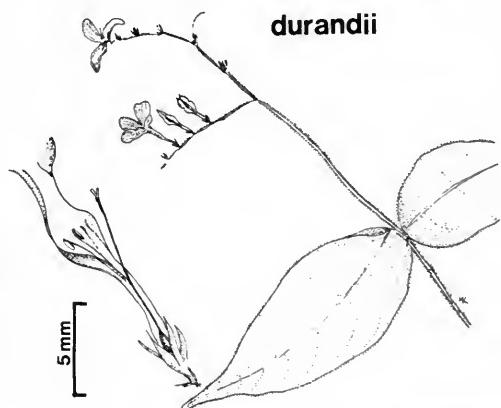
**BUCERAGENIA**  
*glandulosa*



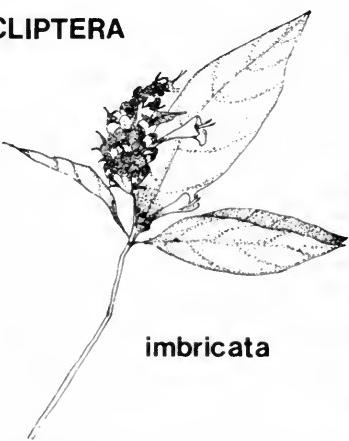
**CHAETOTHYLLAX**  
*eucanthus*



**CHAMAERANTHUM**  
*durandii*



**DICLIPTERA**



*imbricata*

**DICLIPTERA**  
*iopus*

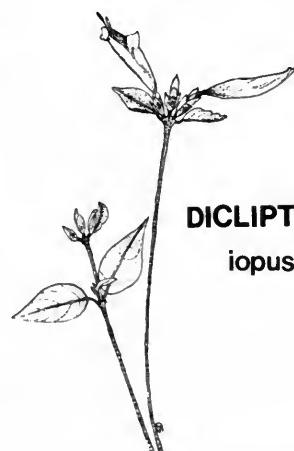
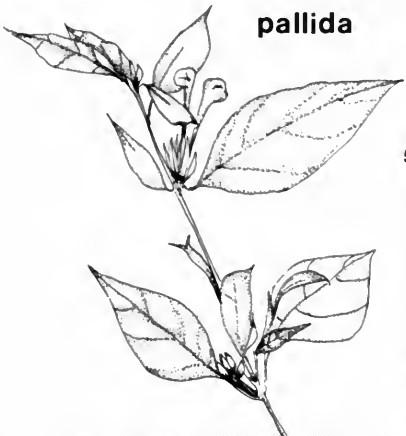


FIG. 4. Acanthaceae: species of *Bravaisia*, *Buceragenia*, *Chaetothylax*, *Chamaeranthemum*, and *Dicliptera* (first part) in Costa Rica.

**DICLIPTERA***pallida*

5cm

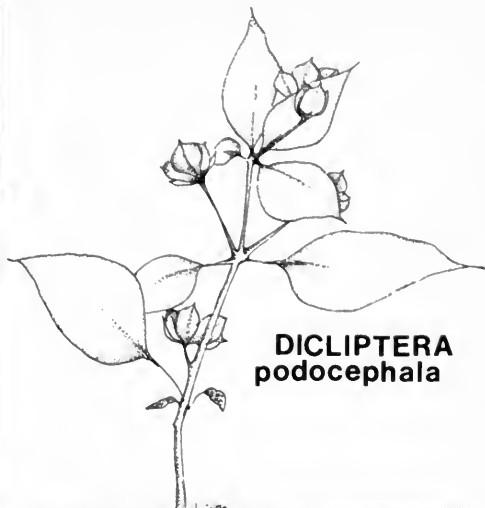
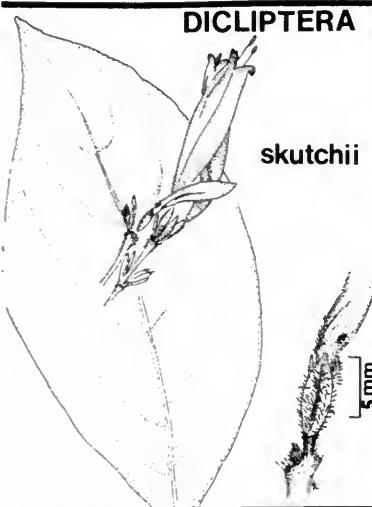
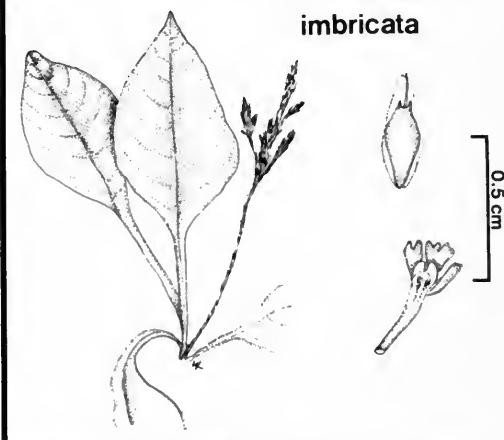
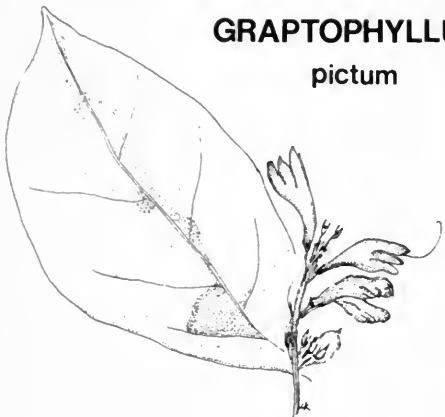
**DICLIPTERA**  
*podocephala***DICLIPTERA***skutchii***DICLIPTERA***trifurca***DICLIPTERA**  
*unguiculata***DYSCHORISTE***valeriana***ELYTRARIA***imbricata*

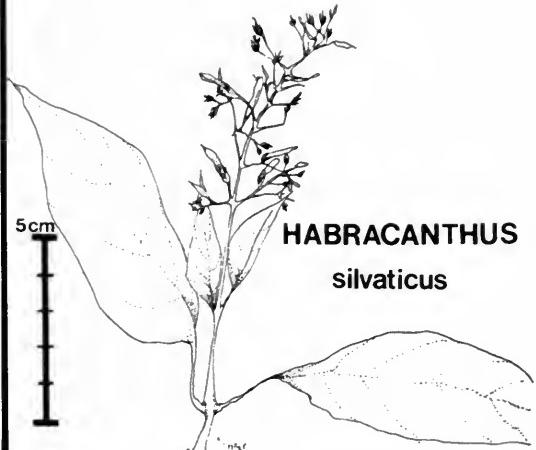
FIG. 5. Acanthaceae: species of *Dicliptera* (concluding part), *Dyschoriste*, and *Elytraria* in Costa Rica.

**GRAPTOPHYLLUM**  
*pictum*

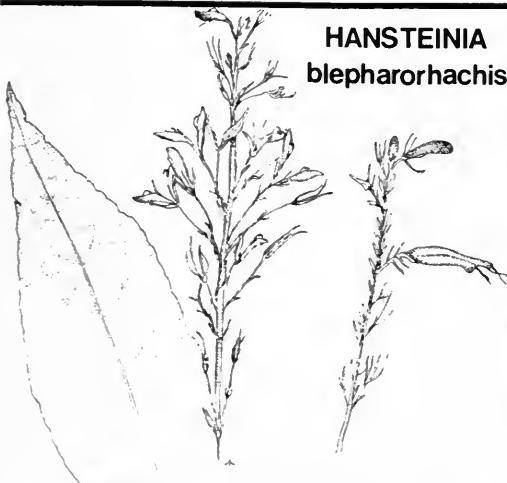


5cm

**HABRACANTHUS**  
*silvaticus*



**HANSTEINIA**  
*blepharorhachis*



**HANSTEINIA**  
*sessilifolia*



**HANSTEINIA**  
*stricta*

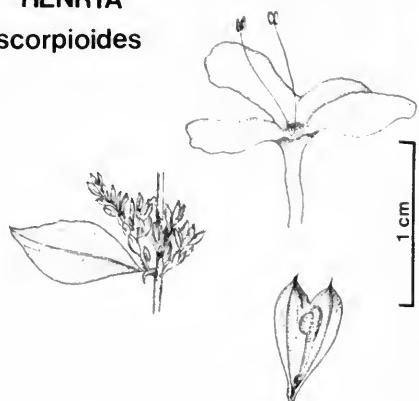


**HANSTEINIA**  
*ventricosa*

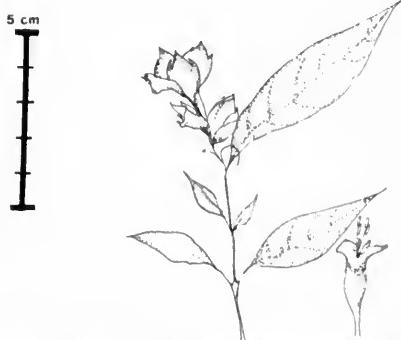


FIG. 6. Acanthaceae: species of *Graptophyllum*, *Habracanthus*, and *Hansteinia* in Costa Rica.

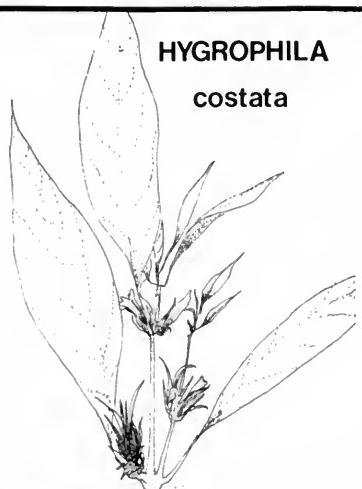
**HENRYA**  
*scorpioides*



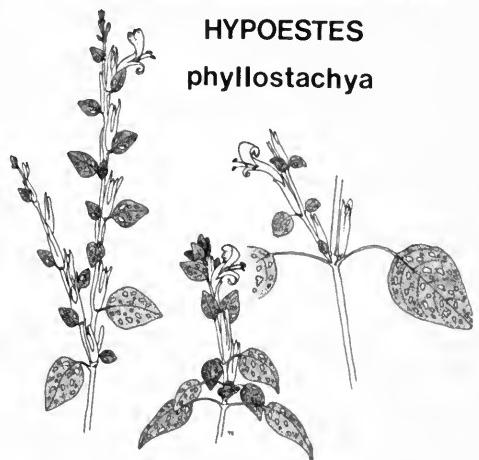
**HERPETACANTHUS**  
*panamensis*



**HYGROPHILA**  
*costata*



**HYPOESTES**  
*phylostachya*



**JUSTICIA**  
*angustibracteata*



**JUSTICIA**  
*aurea*



FIG. 7. Acanthaceae: species of *Henrya*, *Herpetacanthus*, *Hygrophila*, *Hypoestes*, and *Justicia* (first part) in Costa Rica.

**JUSTICIA brenesii**



5 cm

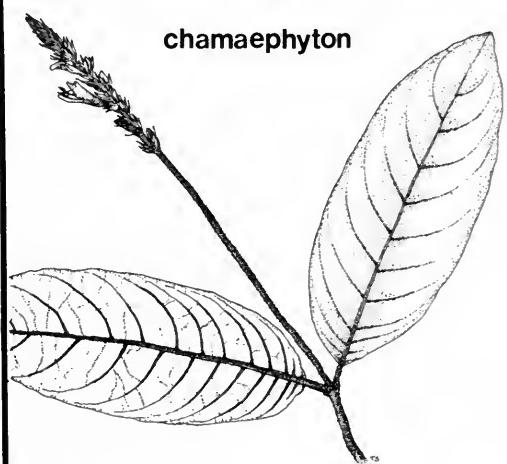
**candelariae**



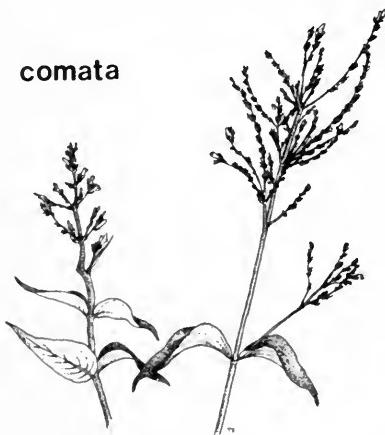
**carthaginensis**



**chamaephyton**



**comata**



1 cm

**costaricana**

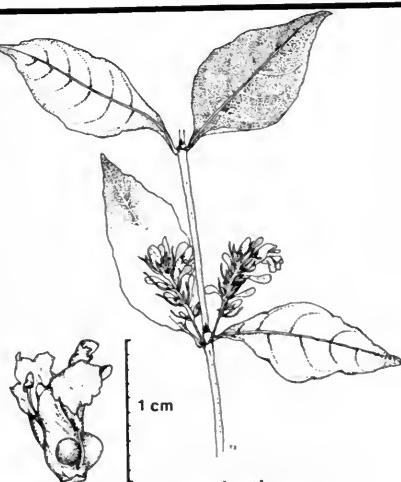


FIG. 8. Acanthaceae: species of *Justicia* (second part) in Costa Rica.

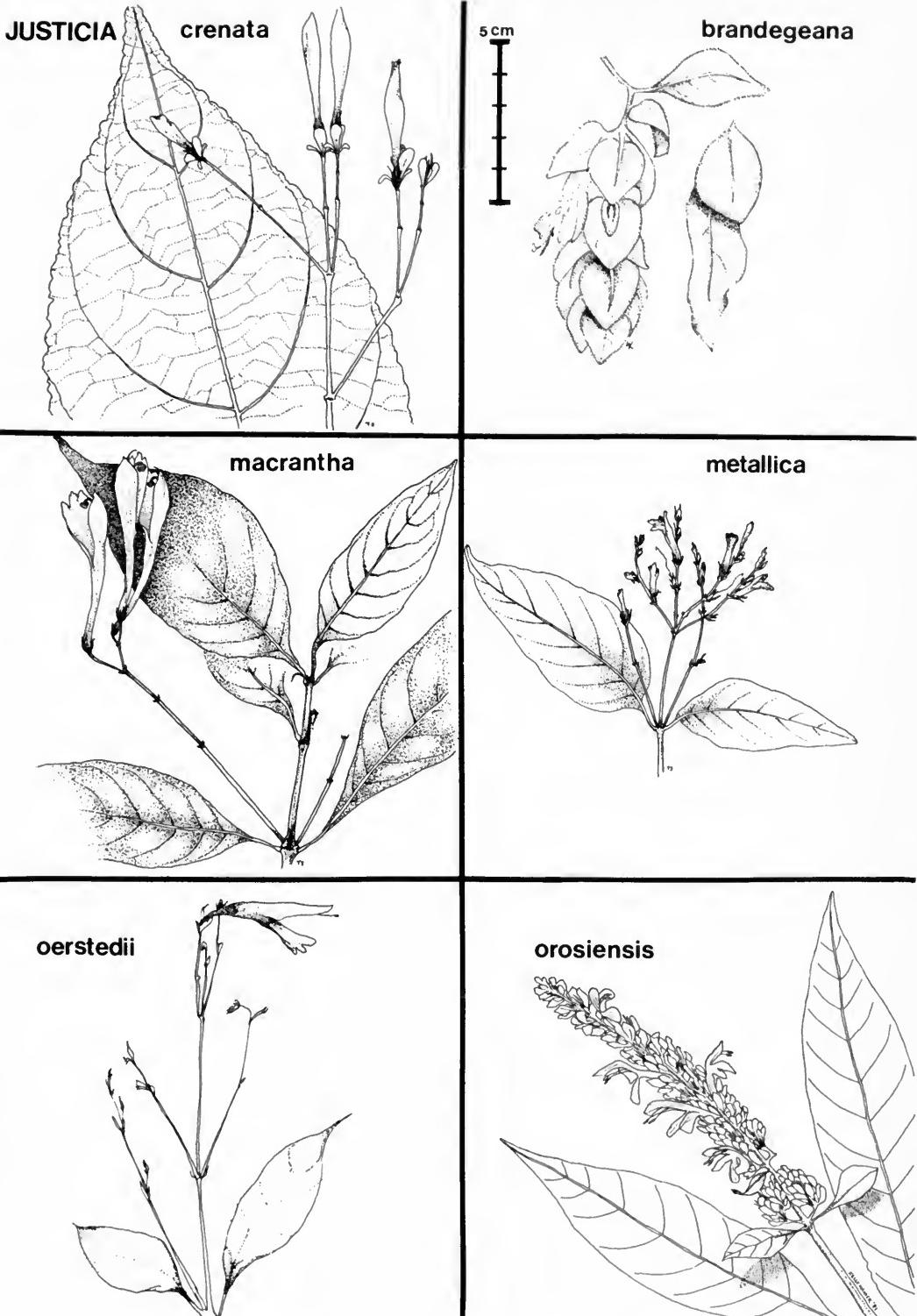


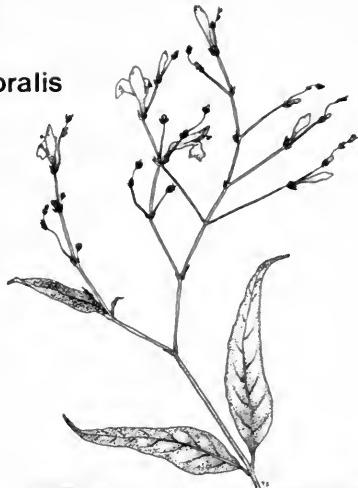
FIG. 9. Acanthaceae: species of *Justicia* (third part) in Costa Rica.

*JUSTICIA* *parvibracteata*

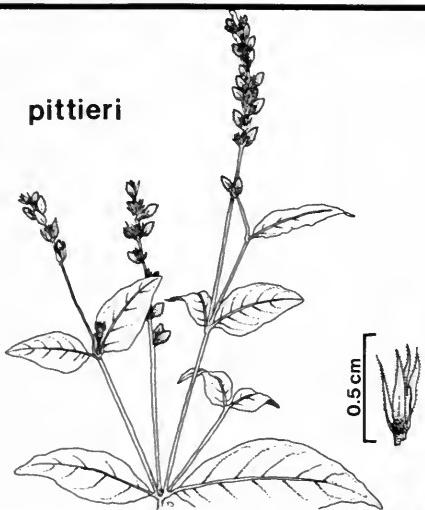


5 cm

*pectoralis*

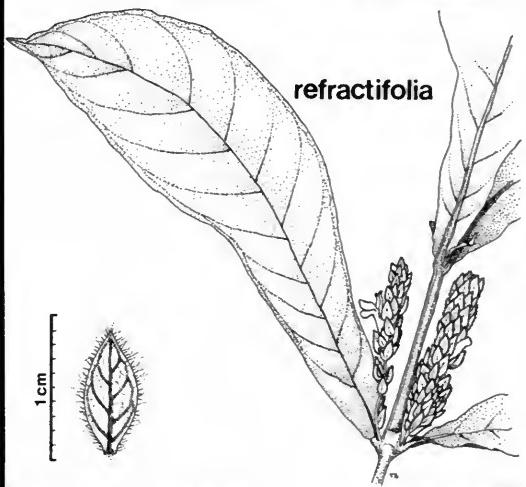


*pittieri*

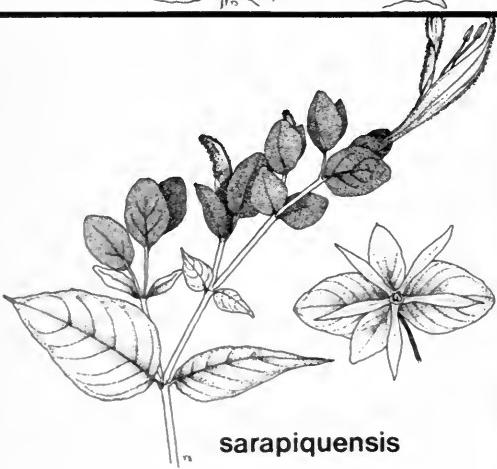


0.5 cm

*refractifolia*



1 cm



*sarapiquensis*

*skutchii*

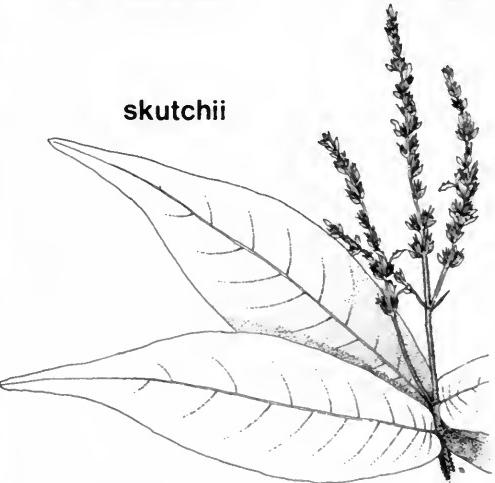


FIG. 10. Acanthaceae: species of *Justicia* (fourth part) in Costa Rica.

**JUSTICIA**  
*spicigera*

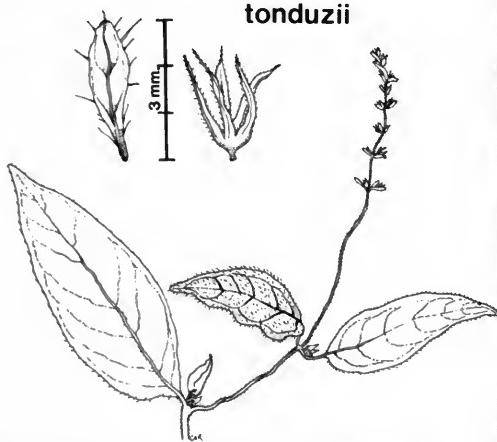


5 cm

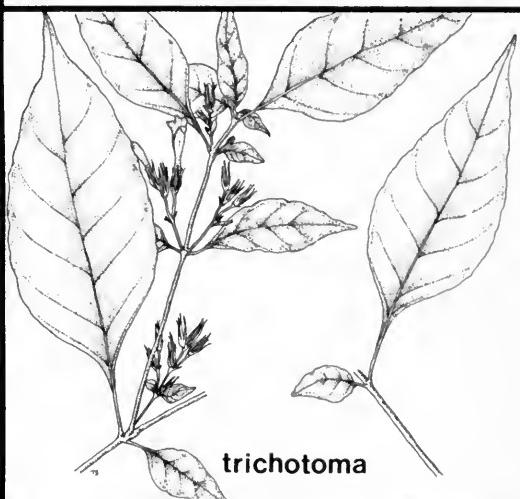
**tinctoria**



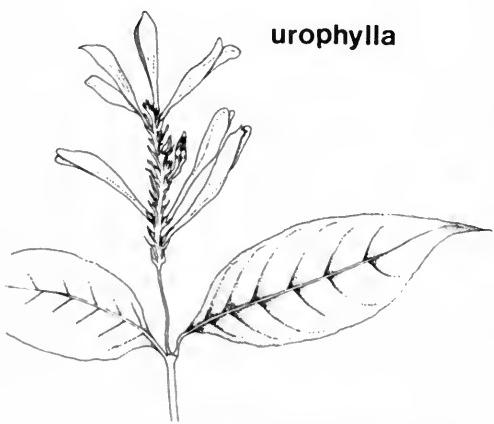
**tonduzii**



**trichotoma**



**urophylla**



**valerii**

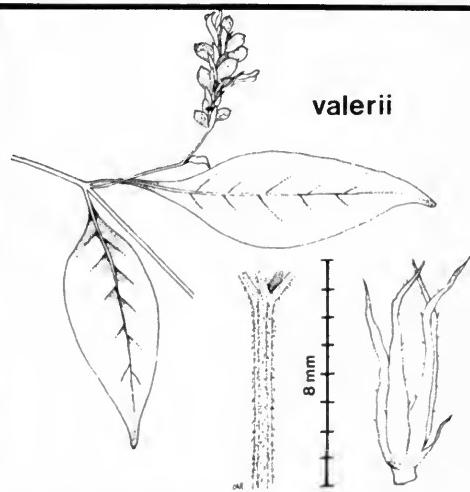


FIG. 11. Acanthaceae: species of *Justicia* (concluding part) in Costa Rica.

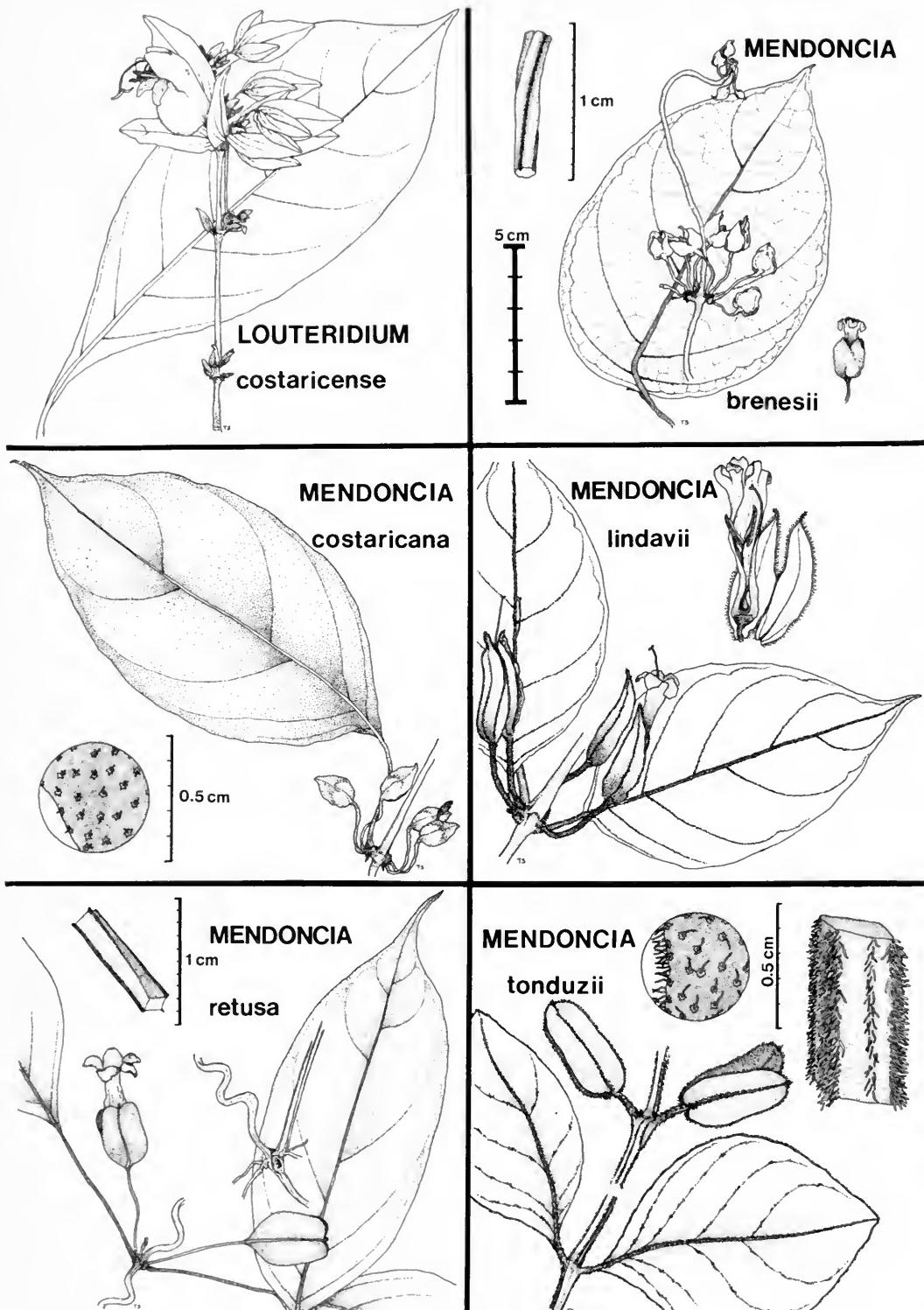


FIG. 12. Acanthaceae: species of *Louteridium* and *Mendoncia* in Costa Rica.

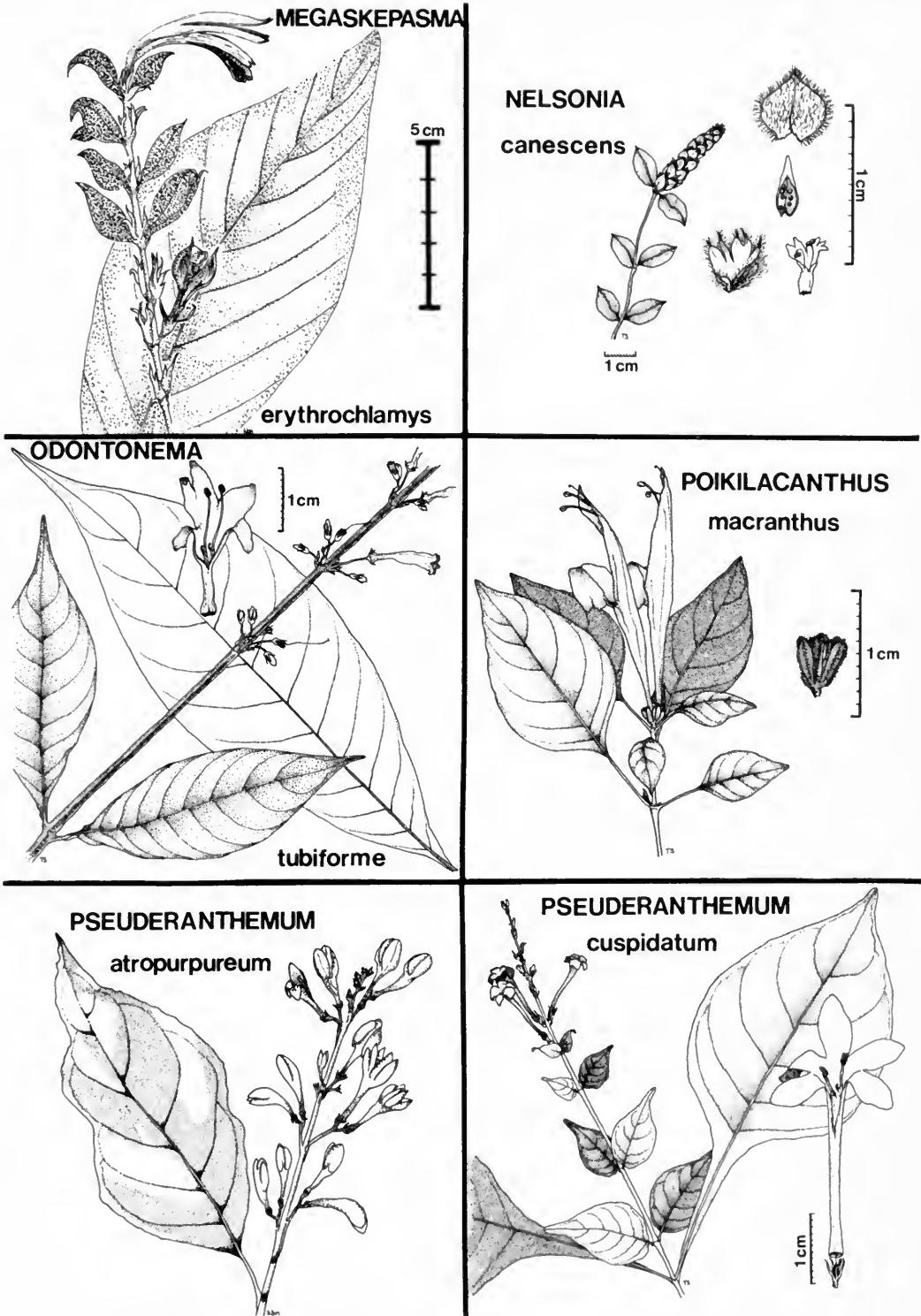


FIG. 13. Acanthaceae: species of *Megaskepasma*, *Nelsonia*, *Odontonema*, *Poikilanthus*, and *Pseuderanthemum* (first part) in Costa Rica.

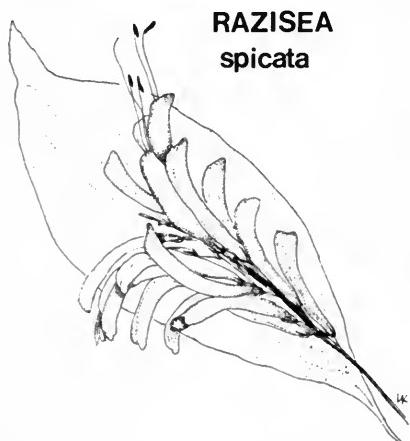
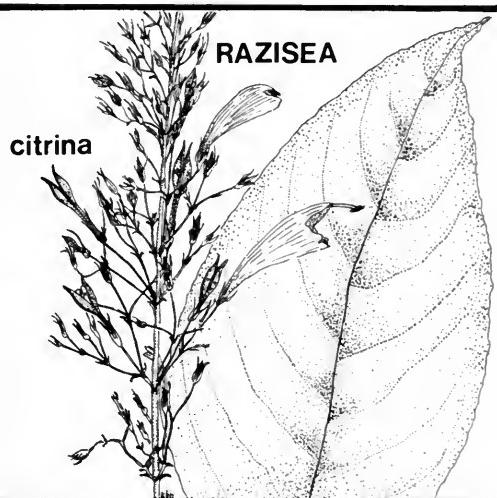
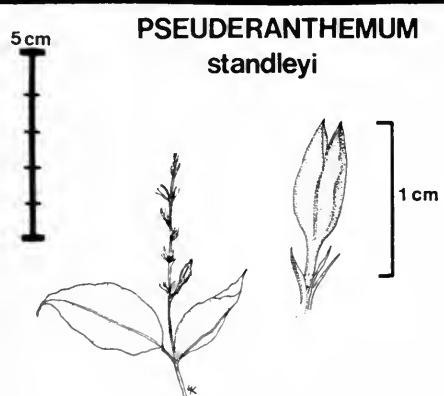
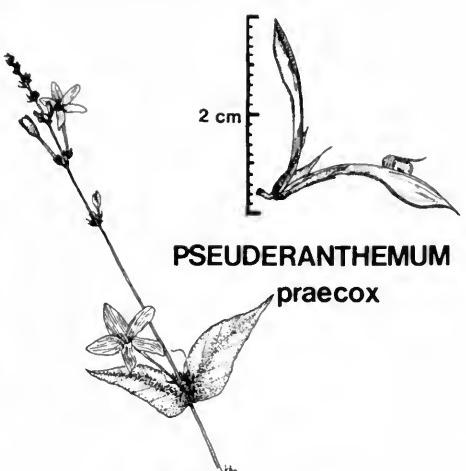
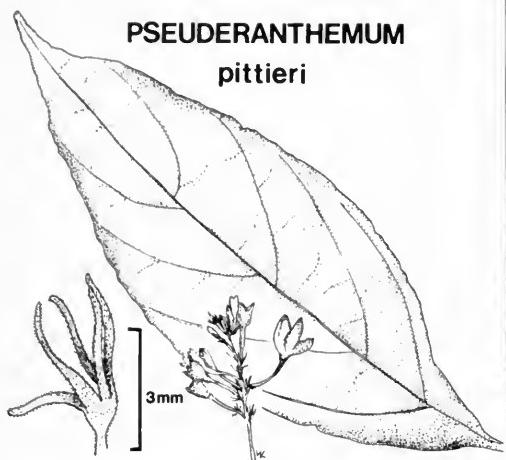


FIG. 14. Acanthaceae: species of *Pseuderanthemum* (concluding part) and *Razisea* in Costa Rica.

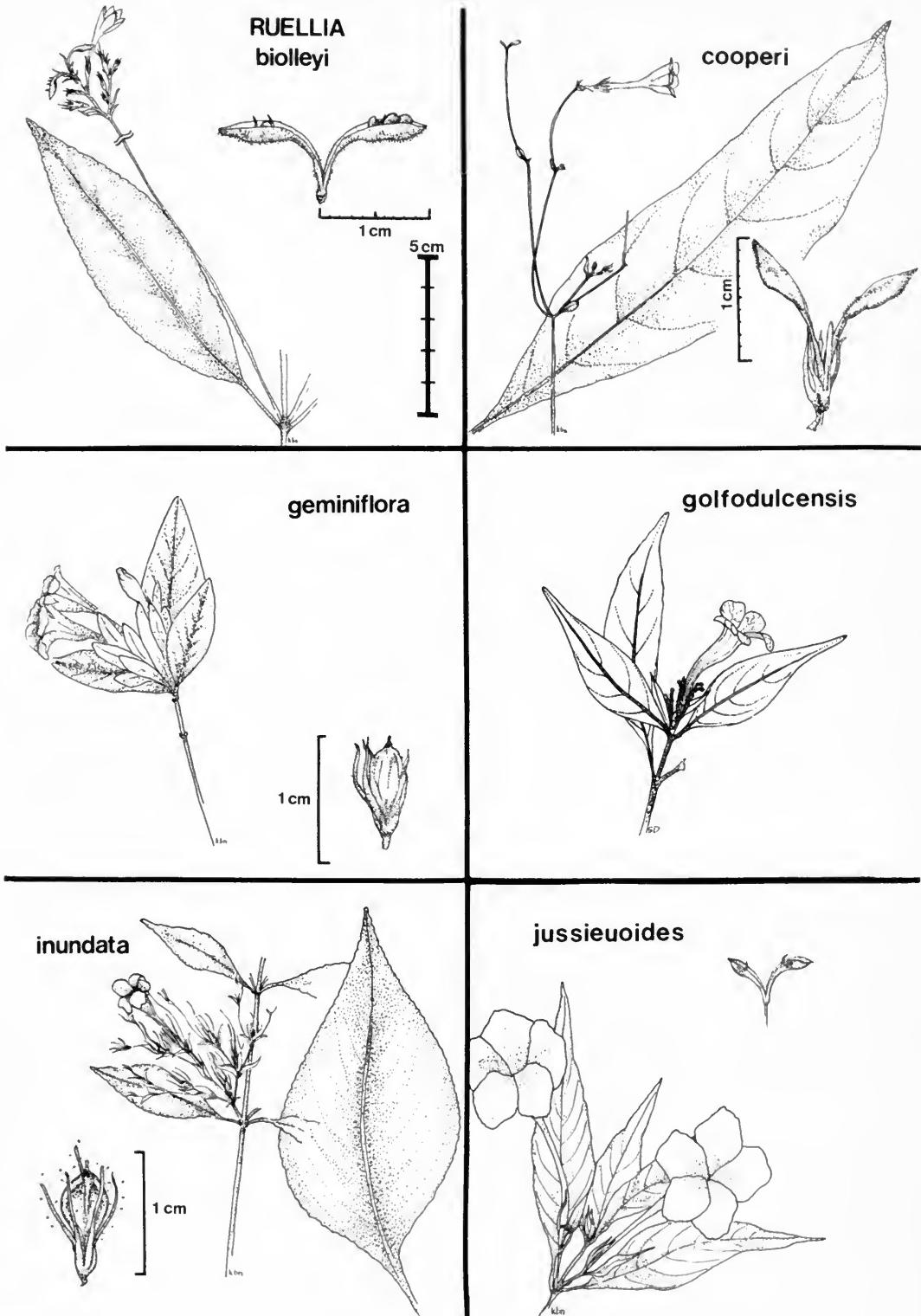
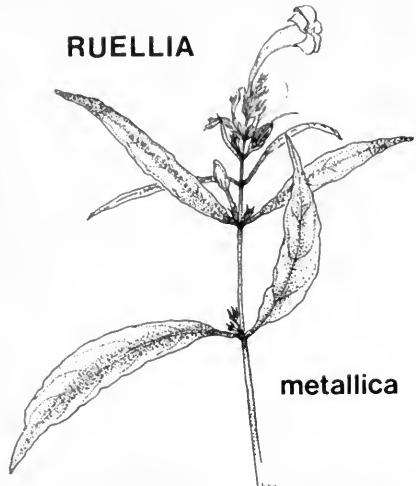


FIG. 15. Acanthaceae: species of *Ruellia* (first part) in Costa Rica.

**RUELLIA**

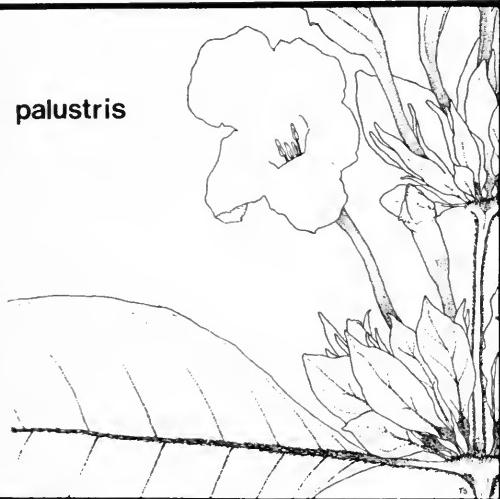


5 cm

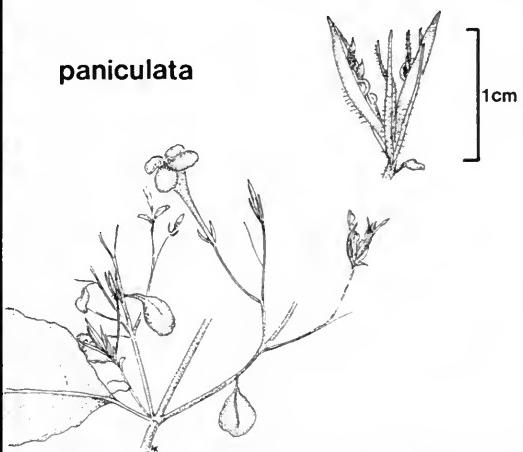


nudiflora

**palustris**



**paniculata**



**pittieri**



**praeclara**

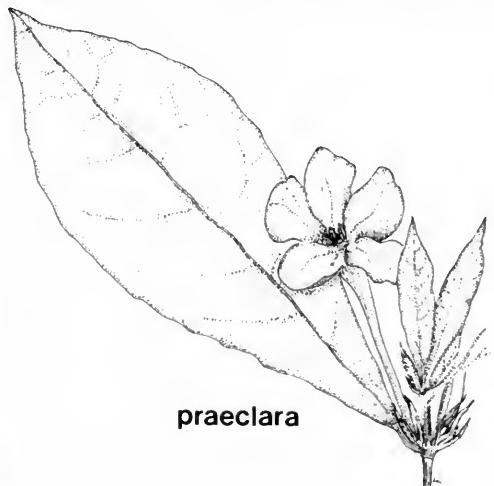


FIG. 16. Acanthaceae: species of *Ruellia* (second part) in Costa Rica.

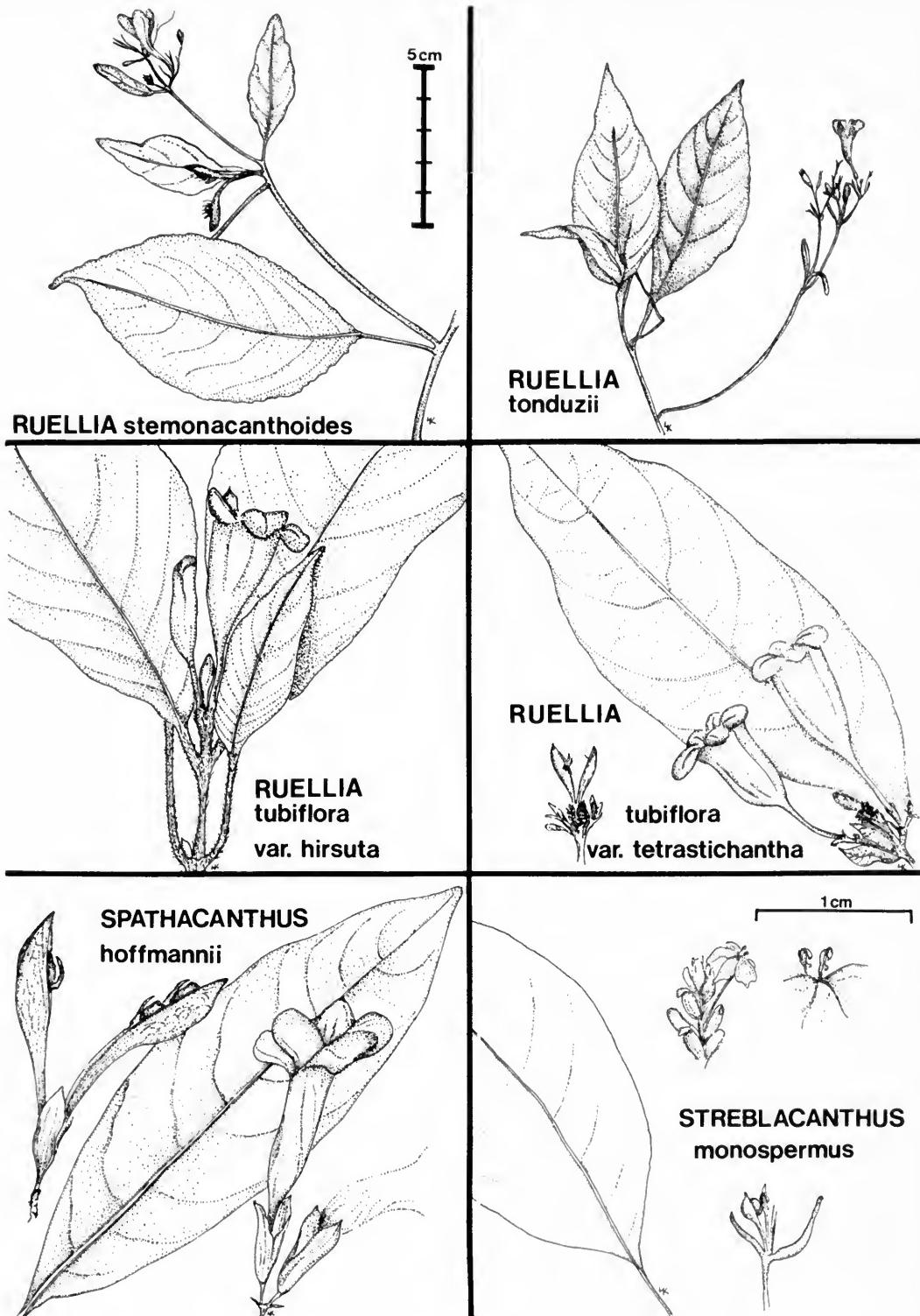
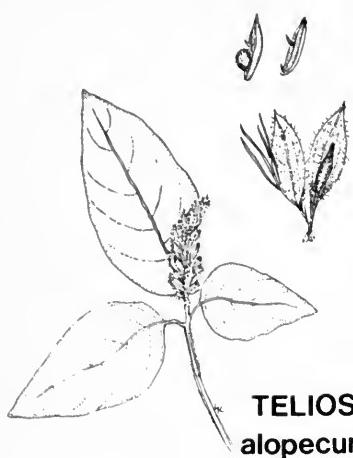
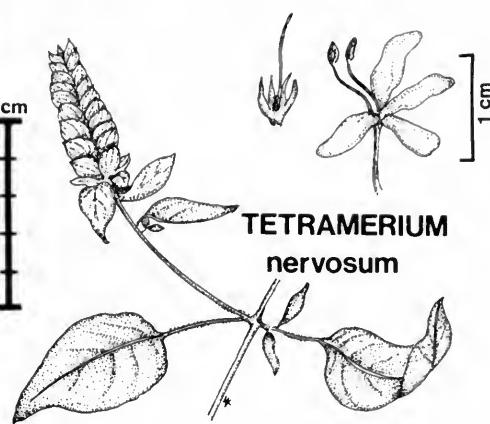


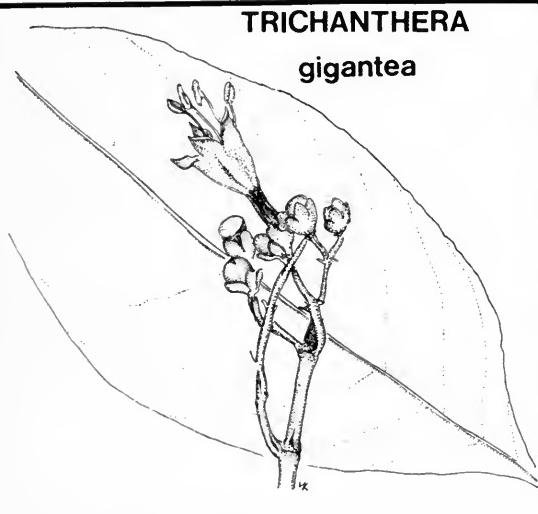
FIG. 17. Acanthaceae: species of *Ruellia* (concluding part), *Spathacanthus*, and *Streblacanthus* in Costa Rica.



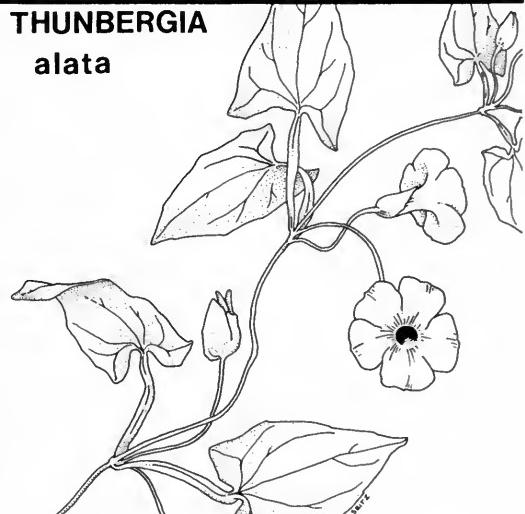
TELIOSTACHYA  
alopecuroides



TETRAMERIUM  
nervosum



TRICHANTHERA  
gigantea



THUNBERGIA  
alata

FIG. 18. Acanthaceae: species of *Teliostachya*, *Tetramerium*, *Trichanthera*, and *Thunbergia* in Costa Rica.

## Key to Genera of Acanthaceae in Costa Rica

- 1a. Fertile stamens 4 ..... 2a  
 1b. Fertile stamens 2 ..... 17a  
     2a. Plants usually scandent; seeds not borne on hooklike funicles ..... 3a  
     2b. Plants not scandent, usually erect herbs or shrubs; seeds borne on hooklike funicles or, if on papilliform funicles, capsules not beaked ..... 4a  
         3a. Fruit a drupe ..... *Mendoncia*  
         3b. Fruit a beaked capsule with 2–4 seeds ..... *Thunbergia*  
     4a. Corolla 1-lipped; stamen filaments thick and prominent; leaves sinuate pinnatifid ..... *Acanthus*  
     4b. Corolla 2-lipped, subequal or regular; stamen filaments narrow; leaves ovate, obovate, elliptic, or oblong, but not sinuate-pinnatifid ..... 5a  
     5a. Calyx spathaceous, 2-lobed; fruits 6.5–8 cm long ..... *Spathacanthus*  
     5b. Calyx 4- or 5-parted, not spathaceous; fruits less than 4 cm long ..... 6a  
     6a. Anthers 1-celled; cystoliths lacking in the leaves ..... *Aphelandra*  
     6b. Anthers 2-celled in at least 1 pair of stamens; cystoliths present in the leaves ..... 7a  
     7a. Calyx segments 4, unequal; bracts with spiny margins ..... *Barleria*  
     7b. Calyx segments 5, either equal or unequal; bracts lacking spiny margins ..... 8a  
     8a. One pair of stamens with 2-celled anthers, the other pair of stamens with 1-celled anthers or sterile ..... 9a  
     8b. Both pairs of stamens with 2-celled anthers ..... 10a  
         9a. Corolla bilabiate; bracts loosely imbricate and conspicuous, 9–14 mm long ..... *Herpetacanthus*  
             9b. Corolla nearly regular; bracts lax and inconspicuous, 1.5–2 mm long ..... *Chamaeranthes*  
     10a. Shrubs or trees; calyx segments often apically rounded or obtuse ..... 11a  
     10b. Herbs, often more or less suffrutescent (rarely shrubs); calyx segments subulate or lanceolate, usually apically acute or acuminate ..... 12a  
         11a. Anthers basally rounded, not spurred; capsules 4-seeded, sericeous ..... *Tricanthera*  
         11b. Anthers basally spurred; capsules 8-seeded, glabrous ..... *Bravaisia*  
     12a. Corolla conspicuously bilabiate, 1 cm long or less; capsules sessile (bilocular from base) ..... 13a  
     12b. Corolla regular or nearly so; capsule stipitate (basal portion solid for at least 2 mm) .. 14a  
         13a. Inflorescence a dense spike; anther cells unequal; seeds 4 per capsule .. *Teliostachya*  
         13b. Inflorescence fasciculate in the leaf axils; anther cells equal; seeds 12–16 per capsule ..... *Hygrophila*  
     14a. Inflorescences in 1-sided racemes; corollas yellow with purplish throats ..... *Asystasia*  
     14b. Inflorescences in cymes, heads, panicles, spikes, or flowers axillary; corollas variously colored, not yellow with purplish throats ..... 15a  
     15a. Flowers in closely imbricate bracted, 4-sided spikes; bracts conspicuous, ovate ..... *Blechum*  
     15b. Flowers otherwise; bracts mostly inconspicuous and linear ..... 16a  
         16a. Calyx segments fused for  $\frac{1}{3}$ – $\frac{1}{2}$  their length; anther cells basally spurred ..... *Dyschoriste*  
         16b. Calyx segments parted nearly to base; anther cells basally rounded ..... *Ruellia*  
 17a. Anthers 1-celled, or if 2, one always much smaller than the other and usually abortive ..... 18a  
 17b. Anthers 2-celled, the cells about equal in size ..... 25a  
     18a. Corolla less than 5 mm long; staminodes present ..... *Buceragenia*  
     18b. Corolla more than 5 mm long; staminodes absent ..... 19a  
         19a. Inflorescences condensed, headlike, bracts white-ciliate, linear subulate ..... 20a  
         19b. Inflorescences open, bracts otherwise ..... 21a  
             20a. Calyx segments 4; corolla ca. 15 mm long ..... *Chaetothylax*  
             20b. Calyx segments 5; corolla more than 20 mm long ..... *Chaetochlamys*  
     21a. Corolla blue; inflorescence a loose, terminal thyrsse (cymose panicles) ..... *Habracanthus*

- 21b. Corolla white, red, magenta, orange, or yellow; inflorescence of single flowers, spikes, racemes, compact thyrses, or racemose panicles ..... 22a
- 22a. Leaves pink-dotted; corolla with 3-lobed upper lip and 1-lobed lower lip ..... *Hypoestes*
- 22b. Leaves lacking pink dots; corolla with 1- or 2-lobed upper lip and 3-lobed lower lip .. 23a
- 23a. Inflorescences paniculate; corolla tube usually abruptly enlarged above the ovary ..... *Hansteinia*
- 23b. Inflorescences a spike or narrow spikelike thyrses; corolla tube expanding gradually from the base ..... 24a
- 24a. Inflorescences spicate; calyx 4-parted ..... *Streblacanthus*
- 24b. Inflorescences a narrow spikelike thyrses; calyx 5-parted ..... *Razisea*
- 25a. Inflorescences condensed, headlike; bracts white-ciliate, linear subulate ..... 26a
- 25b. Inflorescences open, bracts otherwise ..... 27a
- 26a. Calyx segments 4; corolla ca. 15 mm long ..... *Chaetothylax*
- 26b. Calyx segments 5; corolla more than 20 mm long ..... *Chaetochlamys*
- 27a. Cystoliths lacking in the leaves; seeds not borne on hooklike funicles ..... 28a
- 27b. Cystoliths present in the leaves; seeds borne on hooklike funicles ..... 30a
- 28a. Bracts large and showy, more than 20 mm long; corolla more than 30 mm long ..... *Megaskepasma*
- 28b. Bracts small and inconspicuous, less than 10 mm long; corolla less than 15 mm long .. 29a
- 29a. Bracts stiff and awn-tipped; leaves mostly more than 10 cm long ..... *Elytraria*
- 29b. Bracts flaccid and awnless; leaves mostly less than 8 cm long ..... *Nelsonia*
- 30a. Staminodes present ..... 31a
- 30b. Staminodes absent ..... 35a
- 31a. Anther cells basally spurred; flowers in fascicles of 3–8, loosely enclosed by bracts ..... *Sanchezia*
- 31b. Anther cells not basally spurred; flowers not in fascicles enclosed by bracts ..... 32a
- 32a. Bracts conspicuous with spiny margins, more than 2 cm long; calyx 4-parted, segments unequal ..... *Barleria*
- 32b. Bracts inconspicuous, without spiny margins, less than 1 cm long; calyx 5-parted, segments equal ..... 33a
- 33a. Corolla limb subequally 5-parted, tube narrowly cylindrical, limb spreading; stamens included (except *Pseuderanthemum atropurpureum*) ..... *Pseuderanthemum*
- 33b. Corolla limb 2-lipped, tube expanding; stamens exserted ..... 34a
- 34a. Leaf blades mottled; corollas 4.5–8 cm long; plants cultivated ..... *Graptophyllum*
- 34b. Leaf blades green; corollas 1.5–3 cm long; plants mostly wild ..... *Odontonema*
- 35a. Flowers in dense spikes; bracts imbricate, often 4-ranked ..... 36a
- 35b. Flowers borne in lax spikes, panicles, cymes, or thyrses; bracts not imbricate and not 4-ranked ..... 38a
- 36a. Bracts more than 2 cm long; calyx segments widely dissimilar ..... *Barleria*
- 36b. Bracts less than 2 cm long; calyx segments similar ..... 37a
- 37a. Bracts 4-ranked; floral bracts not uniting to form an involucre ..... *Tetramerium*
- 37b. Bracts not 4-ranked; floral bracts uniting almost to apex forming an involucr ..... *Henrya*
- 38a. Stems 6-angled in cross section; calyx subtended by 2 partially united bracts ..... *Dicliptera*
- 38b. Stems rounded to 4-angled; bracts distinct ..... 39a
- 39a. Corolla lobes 4; mature dried capsules black or dark purple ..... *Carlowrightia*
- 39b. Corolla lobes 5; mature dried capsules yellowish brown to dark brown ..... 40a
- 40a. Calyx 3-parted ..... *Louteridium*
- 40b. Calyx 5-parted ..... 41a
- 41a. Bracts large, to 44 mm long ..... *Megaskepasma*
- 41b. Bracts small, less than 20 mm long ..... 42a
- 42a. Corolla more than 6 cm long; leaf pairs unequal (excluding *J. trichotoma* which has unequal leaf pairs); pollen polyporate ..... *Poikilacanthus*
- 42b. Corolla less than 6 cm long (all species except *J. aurea* are less than 5 cm long); leaf pairs equal, with the exception of *J. trichotoma*; pollen mostly 2-porate, some 3- or 4-porate ..... *Justicia*

## *Acanthus* L.

REFERENCE—T. H. Everett, The New York Botanical Garden Illustrated Encyclopedia of Horticulture 1: 21. 1980.

**Herbs or small shrubs.** Leaves petiolate; laminae broad and pinnatifid. Inflorescences in terminal spikes; flowers sessile, borne singly in the axils of the bracts; bracteoles 2 per flower; calyx 4-merous, segments unequal; corolla 1-lipped, the lip 3-lobed; stamens 4, filaments thick and prominent, anthers 1-celled, woolly. Fruit a capsule.

This is a genus of about 20 species in subtropical and tropical regions of the Mediterranean, Asia, and Africa. Two species are often cultivated for their appearance, *A. montanus* T. Anders and *A. mollis* L.

### *Acanthus mollis* L., Sp. pl. 639. 1753. Figure 1.

**Herbs** to 70 cm tall, erect. Leaves mostly basal, petioles to 21 cm long, subquadrangular, 3 mm wide, sparingly pilose; laminae to 60 cm long, 30 cm broad, cordate, sinuate-pinnatifid, dentate, sparingly pilose, more so on the veins. Inflorescences in large, terminal spikes to 65 cm tall; peduncle quadrangular to 35 cm long, 5 mm thick, sparingly pilose, rachis similar; floral bracts ovate, to 3.5 cm long, 1.5 cm broad, apically acute, spine-tipped, puberulous, margins with 6–8 spreading, spiny teeth to 5 mm long; bracteoles linear, 15–20 mm long, 1.5–2 mm broad, spine-tipped, puberulous; upper calyx segment obovate, 4.5 cm long, 2 cm broad, apically 2-lobed, lobes 25 mm long apically acuminate, lower segment obovate, 3.5 cm long, 1.2 cm broad, apically 2-lobed, lobes 22 mm long, apically acuminate, lateral lobes orbicular, 50 mm in diameter, all segments puberulous; corolla whitish, rose or lilac, 1-lipped, to 4 cm long, the lip 3-lobed, lobes suborbicular, 4 mm long, middle lobe to 19 mm broad, lateral lobes 14 mm broad, glabrous, tube short, 4 mm long, glabrous with a circle of hairs 2 mm long at point of attachment of stamens; stamens included within upper calyx lobe, filaments sigmoid, to ca. 20 mm long, 2 mm thick, prominent, indurate, glabrous; anthers 10 mm long, 2 mm broad. Fruits not seen; seeds 4.

A common planting in yards and flower gardens of the Meseta Central. This species is a native of Italy.

## *Aphelandra* R. Br.

REFERENCES—D. C. Wasshausen, The Genus *Aphelandra*, Smithsonian Contr. Bot. No. 18. 1975. L. A. McDade, Systematics and reproductive biology of the Central American species of the *Aphelandra pulcherrima* complex (Acanthaceae). Ann. Missouri Bot. Gard. 71: 104–165. 1984.

**Shrubs or suffrutescent herbs.** Leaves opposite; laminae usually large, oblong to elliptic, margins toothed, lobed, crenate or entire. Inflorescences of terminal or axillary spikes, spikes often conspicuous with showy bracts and flowers; bracts most often imbricate, certain species bearing dorsal clusters of submarginal glands (extra-floral nectaries) which may be conspicuous, margins of bracts entire, toothed or ciliate; bracteoles various, rudimentary in a few species; flowers with 5-merous calyx, segments separate nearly to base, frequently lanceolate and striate-veined, posterior segment usually broader than others; corolla straight or curved, the limb usually bilabiate, upper lip erect, 2-lobed or entire, lower lip reflexed or spreading, 3-lobed, the middle lobe often larger than the laterals; stamens 4, usually exserted, but usually not beyond the upper lip of the corolla; anthers narrow, 1-celled, often pilose dorsally and held together at apices by intertwining hairs. Fruits a capsule, usually clavate, 4-seeded.

*Aphelandra* is one of the larger genera of the family and is endemic to tropical America. Species of the genus are often quite showy and yet they are seldom cultivated because of difficulties in cultivation. In Costa Rica the genus is represented in a variety of forested habitats from sea level to elevations of 1500 m, including the dry forests of the Pacific watershed, cloud forests of higher elevations, and in the rain forests of the Caribbean watershed. *Aphelandra scabra* of the Pacific dry forests is probably the most abundant and widespread species in the genus.

## Key to Species of *Aphelandra*

- 1a. Bracts toothed ..... 2a
- 1b. Bracts entire ..... 8a
- 2a. Bracts with submarginal glands ..... 3a
- 2b. Bracts without submarginal glands .....
  - 3a. Bracts more than 20 mm long; petioles 10–30 mm long ..... *A. storkii*
  - 3b. Bracts less than 16 mm long; petioles 0–5 mm long ..... *A. scabra*

- 4a. Bracts less than 15 mm long; corolla less than 2 cm long ..... 5a
- 4b. Bracts more than 20 mm long; corolla more than 5 cm long ..... 6a
- 5a. Leaves mostly less than 10 cm long; bracts more than 10 mm long ..... *A. seibertii*
- 5b. Leaves more than 10 cm long; bracts less than 8 mm long ..... *A. tonduzii*
- 6a. Bracts with 1–2 pairs of teeth above midpoint; peduncle more than 10 mm long ..... *A. tridentata*
- 6b. Bracts with spine-tipped, serrate margins; peduncle short, less than 5 mm long ..... 7a
- 7a. Leaves elliptic to ovate, 3–8.5 cm broad ..... *A. aurantiaca* var. *aurantiaca*
- 7b. Leaves lanceolate, 1.5–2.5 cm broad ..... *A. aurantiaca* var. *stenophylla*
- 8a. Bracts with submarginal glands ..... 9a
- 8b. Bracts without submarginal glands ..... 13a
- 9a. Submarginal glands consisting of numerous, minute glands appearing as a dull, alveolar spot ..... 10a
- 9b. Bracts with submarginal glands represented by 1 or more well-defined, elliptical, shiny areas ..... 12a
- 10a. Petioles short, to ca. 1 cm long; corolla puberulous; capsules clavate ..... *A. lingua-bovis*
- 10b. Petioles 2–8 cm long; corolla papillose; capsules oblong or ovate ..... 11a
- 11a. Bracts acuminate to acute, 7–9.5 mm long; calyx segments 9–11 mm long ..... *A. leonardii*
- 11b. Bracts obtuse to acute, 10–11 mm long; calyx segments 15–17 mm long ..... *A. campanensis*
- 12a. Bracts 6–13 mm long, drying to light or dark brown color; younger stems strigose ..... *A. gulfodulcensis*
- 12b. Bracts 16–20 mm long, drying to light orange color (orange-red when fresh); younger stems velutinous ..... *A. sinclairiana*
- 13a. Bracts more than 3 cm long; young stems quadrangular, puberulous to glabrous ..... *A. dolichantha*
- 13b. Bracts less than 8 mm long; stems terete, pilose ..... *A. tonduzii*

***Aphelandra aurantiaca* (Scheidw.) Lindl.** in Edwards, Bot. Reg. 31: pl. 12. 1845. *Hemisandra aurantiaca* Scheidw., Bull. Acad. Roy. Sci. Bruxelles 9: 22. 1842. Figure 1.

Suffrutescent **herb** to **shrub**, erect, 1 m tall; young stems **terangular**, older stems **terete**, internodes between leaf-bearing nodes 2–6 cm long, 2–4 mm thick, younger stems **glabrous** to **velutinous**. Leaves petiolate; petioles to 1 cm long, **glabrous**; laminae elliptic to ovate with undulate to entire or sinuate-repand margins, frequently thickened, 8–28 cm long, 2.5–12.5 cm broad, apically acuminate, basally attenuate, occasionally obliquely decurrent, **glabrous** except for occasional puberulence along veins, costa and lateral veins prominent, reticulations conspicuous on upper surface and obscure beneath. Inflorescences in mostly terminal, quadriflorous spikes to 17 cm long, 3 cm broad, excluding the corollas; peduncle short, to 3 mm long, 2 mm thick, puberulous, rachis similar, flattened at the nodes; **bracts** elliptic or ovate, imbricate, 2.5–3 cm long, 0.75–1 cm broad, apically acute, basally cuneate, puberulous-glandular on both surfaces, reticulations prominent on inner surface, margins serrate, serrations tipped with spines to 1.5 mm long; bracteoles narrowly lanceolate, to 10 mm long, 0.5 mm broad, puberulous on both surfaces, striate-ridged. **Flowers** with calyx segments 1 cm long, posterior segment oblong, 2.5 mm broad, with a 3-toothed apex, lateral and anterior segments linear-lanceolate, 1 mm broad, all segments

puberulous with striate ridges culminating at the base in callus tissue ca. 1 mm thick; corolla red, orange-red, or scarlet, tube to 4 cm long, 3 mm broad, bilabiate, upper lip to 2 cm long and 1 cm broad above base, oblong-ovate, apiculate at apex, forming a partial hood over the anthers, lower lip 3-lobed, elliptic middle lobe 2 cm long, 1.2 cm broad, apically acute, lateral lobes elliptic-ovate, to 1.2 cm long, 0.75 cm broad, apically acute, puberulous on both surfaces; style to 4.6 cm long, sparingly puberulous with ascending hairs, ovary puberulous at apex. Fruits 1.6 cm long, sparingly puberulous, seeds hispidulous.

Found in dense forests from Mexico to Bolivia. *Aphelandra aurantiaca* is recognized by its large, spiny toothed bracts which lack submarginal glands. It is one of the most easily recognized species of the genus and does not closely resemble any of the other Costa Rican species.

#### ***Aphelandra aurantiaca* (Scheidw.) Lindl. var. *aurantiaca***

The characteristic features of this variety are elliptic to ovate laminae 8–21 cm long, 3–8.5 cm broad with undulate to entire margins that are usually thickened.

This variety is found in dense forests from Mexico to Bolivia. In Costa Rica it ranges from the wet evergreen forests of the Caribbean watershed to the moist evergreen forests around the Meseta Central and into Guanacaste to Liberia, at elevations near sea level to above 1500 m. Flowering collections have been made from August through January.

**Aphelandra aurantiaca** (Scheidw.) Lindley var. **stenophylla** Standley, Publ. Field Columbian Mus., Bot. Ser. 4: 324. 1929; Field Mus. Nat. Hist., Bot. Ser. 10: 59. 1931. *Aphelandra repanda* Nees in DC., Prodr. 11: 728. 1847.

The characteristic features of this variety are lanceolate leaves, laminae 20–28 cm long, 1.5–2.5 cm broad, gradually narrowed apically and basally, margins sinuate-repand.

Commonly found in wet forests from Central America to Bolivia. Collected mostly in Costa Rica in the Meseta Central region from an altitude of 1300 m down to elevations of 700 m near Tilarán, Guanacaste.

**Aphelandra campanensis** Durkee, Ann. Missouri Bot. Gard. 65: 162. 1978. Figure 1.

**Shrub** to 3.5 m tall; **internodes** between leaf-bearing nodes 2.5–8 cm long, 3.5–7.5 mm thick, tetrangular, sparingly to moderately strigose, lenticels corky ca. 1 mm long. **Leaves** with strigose petioles to 5 cm long; laminae elliptic, 14–30 cm long, 7–12.5 cm broad, apically acuminate, basally attenuate, margins entire or undulate, glabrous to sparingly strigose above, strigose beneath, more so on the costa and veins. **Inflorescences** in terminal spikes borne singly or in clusters, to 24 cm long, 1–1.5 cm broad excluding corollas; peduncles short, 5–13 mm long, sparingly strigose; rachis glabrate; **bracts** rhombic-ovate, 10–11 mm long, 7–8 mm broad, apically obtuse to acute, apiculate, glabrate and minutely roughened with strigose hairs in some, the nerves prominent except toward the apex, with 2 submarginal glandular areas at about the midpoint, each consisting of a compact cluster of numerous, minute, dull brown glands making an elliptic, alveolar spot 1.5–2.0 mm long and 0.5–0.75 mm broad, bract margins subhyaline, entire; bracteoles falcate-lanceolate, 9–10 mm long, 2.5–3.25 mm broad, keeled, striate-nerved, densely hirsute along the keel, marginal area glabrous, subhyaline, sparingly papillose. **Flowers** with the calyx segments conspicuously longer than the bracts, segments 15–17 mm long, apically obtuse, apiculate, striate-nerved, glabrous outside, anterior segments lanceolate, 3.5 mm broad, posterior segment ovate, 7 mm broad; **corolla** orange-red, bilabiate, densely papillate outside and inside, 5–7 cm long, the tube to 4

cm long, 5 mm broad basally, constricted to 3.5 mm broad just above the apex of the ovary, expanding to 11 mm broad at the mouth, the upper lip ovate, ca. 19 mm long, 9 mm broad, apically with 2 acuminate lobes ca. 6 mm long, the lower lip spreading at maturity, the middle lobe ovate, to 23 mm long, 11 mm broad, apically acuminate, the tip keeled, the lateral lobes triangular, the free portion 1.5 mm long, 2 mm broad, fused to the upper lip for most of their length, the tip rounded; **stamens** extending to the tip of the upper lip, the anthers 9 mm long, 1.5 mm broad, acute at both ends; style and ovary glabrous. **Fruits** ovate, ca. 20 mm long, 6 mm broad, the tip rounded, the surface shiny and puncticulate; seeds suborbicular, 4 mm in diameter, the surface minutely roughened.

This species occurs in lowland to mid-elevation (1000 m) rain forests mainly in western provinces bordering on the Caribbean in Panama, but extends into Costa Rica. Only one Costa Rican collection, *McDade 242 (DUKE)*, has been observed. Flowering collections have been made from August through November.

*Aphelandra campanensis* is recognized by its shrubby habit; compact terminal inflorescences with imbricate bracts that lack marginal teeth, are apically obtuse to acute, and have two submarginal glandular areas, each consisting of numerous minute, dull, alveolar-appearing glands; its calyx lobes conspicuously longer than the bracts; and its 5- to 7-cm long corollas that are orange-red and are externally papillate. It may be confused with *A. leonardii*, which differs in its shorter bracts (7 to 9.5 mm long vs. 10 to 11 mm), which are apically acute to acuminate, its shorter calyx segments (9 to 11 mm long vs. 15 to 17 mm), and its bright red corollas. It may also be confused with *A. lingua-bovis*, which can be distinguished by its clavate capsules, bright red bracts, and puberulous corollas.

**Aphelandra dolichantha** Donnell Smith, Bot. Gaz. (Crawfordsville) 27: 438. 1899. Figure 1.

**Shrubs** or suffrutescent herbs ca. 1 m tall; young **stems** quadrangular, **internodes** between leaf-bearing nodes 1–5 cm long, 2.5–4 mm thick, puberulous to glabrous, hairs brownish. **Leaves** petiolate, petioles 0.5–2 cm long, minutely strigose; laminae mostly elliptic, to 24 cm long, 10.5 cm broad, apically acuminate, basally attenuate, margins entire, glabrous above, glabrous to finely strigose below, when present, hairs more dense on costa and lateral veins, drying to a lighter green than the upper surface, costa and lateral veins prominent. **Inflorescences** of terminal, sessile spikes, borne singly or occasionally in small clusters, to 13 cm long, 1.5 cm broad excluding corollas; rachis puberulous; **bracts** closely imbricate at anthesis, spreading at time of fruiting, green when fresh,

drying reddish brown, ovate-lanceolate to oblanceolate, to 3.5 cm long, 1 cm broad, apically acuminate to subacute, glabrous, margins ciliolate; bracteoles linear, to 8 mm long, 0.5 mm broad, with appressed pilose hairs, 0.5 mm long plus smaller gland-tipped hairs. **Flowers** 6.5–7.2 cm long; **calyx** minute, segments linear-subulate, ca. 1.5 mm long, 0.25 mm broad, ciliolate; **corolla** white, the tube slender, to 5 cm long, nearly cylindrical, basally 2 mm broad, 3.5 mm broad at throat, glandular-puberulous, the upper lip erect, oblong, to 12 mm long, 6 mm broad, 2-lobed, the lobes 5 mm long, 3 mm broad at base, apically rounded, the lateral lobes oblong to 17 mm long, 6 mm broad, apically rounded, the middle lobe of the lower lip to 22 mm long, 9 mm broad, apically rounded; **stamens** included, filaments ca. 6 mm long, affixed just below the throat, anthers 2.5 mm long, basally apiculate, adhering by terminal hairs; style included. **Fruits** clavate, 17 mm long, 4 mm broad, 3 mm thick, glabrous, minutely punctate, perianth persistent except early deciduous corolla; seeds flattened, ovoid to obliquely ovoid, to 5 mm long, 4 mm broad, 1.5 mm thick dark brown, smooth.

Found in lowland wet evergreen forests on the Caribbean side of Costa Rica, in higher wet evergreen forests of Bajo La Honduras to an altitude of 1400 m, and at 750 m near Tilarán in Guanacaste. Flowering collections have been made from April through October. The species is also found in similar habitats of Panama and Colombia.

*Aphelandra dolichantha* is recognized by its long (more than 3 cm), narrow (1 cm) bracts, which lack submarginal glands, and its large (more than 5 cm long), narrow, white flowers. It slightly resembles *A. storkii*, but this species has bracts that are shorter, with toothed margins and submarginal glands, orange flowers, and apparently a much more restricted habitat.

***Aphelandra golfodulcensis* McDade, Ann. Missouri Bot. Gard. 69: 405. 1982. Figure 2.**

**Shrubs** to small trees 1–6 m tall; **internodes** between leaf-bearing nodes 1–4 cm long, 3–6 mm thick, terete, densely retrorse. **Leaves** on moderately strigose petioles to 1 cm long; laminae elliptic to oblanceolate, 8.5–30 (45) cm long, 2–8 (15) cm broad, apically acute to acuminate, basally attenuate, margins entire or slightly undulate, sparsely strigose on the veins above, moderately strigose beneath. **Inflorescences** borne in numerous terminal spikes to 15 cm long, 1 cm broad excluding corollas; peduncles to 10 cm long, moderately pubescent; rachis glabrous to minutely puberulous; bracts imbricate, rhombic-ovate, apically acute, 6–10 mm long, 4–7 mm broad, green to dull brown-orange, margins ciliolate, with 2 clusters of submarginal glands just below the middle of the dorsal surface, glands ca. 0.75 mm long, 0.5 mm broad, 1–7 glands per cluster; bracteoles narrowly ovate, apically attenuate, 4–6.5 mm long, 2–4 mm broad, green,

moderately puberulous. **Flowers** with calyx segments 6–9 mm long, apically acute, green, finely striate, minutely puberulous, posterior segment narrowly ovate, 3–4 mm broad, anterior segments broadly lanceolate, 2–2.5 mm broad, lateral pair narrowly lanceolate, ca. 1.5 mm broad; corolla orange to red, 6.0–7.3 cm long, puberulous, tube 3.8–4.0 cm long, 2–3 mm broad basally, expanding to 6–8 mm broad at the mouth, the upper lip erect, elliptic, 17–19 mm long, 7–11 mm broad, 2-lobed, the lobes triangular, acuminate, 6–10 mm long, the lateral lobes of the lower lip triangular, 3 mm long, 5–7 mm broad, middle lobe broadly lanceolate, spreading, 22–26 mm long, 6–9 mm broad, apically acuminate; **stamens** exerted to just below the tip of the upper lip and enclosed by it. **Fruits** clavate, terete, 19–23 mm long, 5–8 mm broad, 5.5–7 mm thick, glabrous; seeds 4, slightly flattened, orbicular, 4–6 mm in diameter.

According to McDade this species is found primarily in the wet lowlands of the Golfo Dulce region in Puntarenas Province. It extends into the Burica Peninsula of Panama, to mid-elevations above the Golfo Dulce region, and to the north in Alajuela and Guanacaste, where local conditions provide similar moist habitats. Flowering collections have been made from December through March.

*Aphelandra golfodulcensis* is recognized by its imbricate, rhombic-ovate bracts (6 to 10 mm long, 4 to 7 mm broad), which are green or dull brown-orange and minutely puberulent, its minutely puberulent corolla, and its glabrous green fruits. It most closely resembles *A. sinclairiana*, which differs in its larger obovate-rhombic bracts (16 to 21 mm long, 14 to 20 mm broad), which are bright orange, its corollas, which are short velutinous, and its black fruits, which are pubescent. According to McDade these two species are closely related, as observed in experimental hybridizations and several collections of putative hybrids from northeastern Costa Rica. She reports further that these hybrids are morphologically intermediate between the two parental species and are sterile.

***Aphelandra leonardii* McDade, Ann. Missouri Bot. Gard. 69: 408. 1982. Figure 2.**

**Shrubs** 1–5 m tall; younger stems quadrangular, older stems terete, **internodes** between leaf-bearing nodes 2–5 cm long, 1.5–2.5 mm thick, strigose, lenticels scattered, oval, ca. 0.5 mm long, corky. **Leaves** petiolate, petioles ca. 3 cm long, pubescence that of the costa; laminae elliptic to elliptic-obovate, 10–20 (30) cm long, 4–10 cm broad, apically acute to acuminate, basally attenuate, margins shallowly crenate to slightly undulate, glabrous above, sparingly strigose to glabrous below. **Inflorescences** in terminal spikes, quadrangular, to 8 cm long, 1

cm broad excluding corollas; peduncle subsessile, rachis glabrous to sparingly puberulous; bracts rhombic-ovate, imbricate, green to bright orange, 7–9.5 mm long, 5–6 mm broad, apically acute to acuminate, tip apiculate, keeled and striate-nerved, minutely puberulous on upper bracts, lower bracts increasingly strigose mostly over the keel, with submarginal glandular areas just below mid-point consisting of numerous, minute (0.2 mm), often shiny brown to dark brown glands making an elliptic, alveolar spot 1–1.5 mm long, 0.5–1 mm broad, margins ciliolate; bracteoles falcate, keeled, to 8 mm long, 2.5 mm broad, striate-nerved, finely puberulous outside except woolly keel, glabrous inside. Flowers 6.5–7.5 cm long; calyx segments conspicuously longer than the bracts, 9–11 mm long, glabrous, anterior segments oblong, all others lanceolate, apically acute, anterior segments 3 mm broad, lateral segments 2.5 mm broad, posterior segment 5 mm broad, all striate-nerved; corolla bright red, bilabiate, papillate outside and inside, tube to ca. 5 cm long, 4 mm broad basally, constricted to ca. 2 mm broad just above the ovary, expanding to 9 mm broad at the throat, upper lip erect, ca. 20 mm long, basally 9 mm broad, consisting of 2 acuminate lobes ca. 12 mm long, the lower lip spreading at maturity, with 3 lobes, the middle lobe lanceolate, ca. 26 mm long, 8 mm broad, the lateral lobes ca. 6 mm long, acute, connate to the upper lip for most of their length; stamens extending to ca. the length of the upper lip. Fruits oblong, flattened, glabrous, 17.5–19 mm long, ca. 5 mm broad, 3.5–4 mm thick; seeds irregularly orbicular, strongly flattened, 3.5–6.5 mm in diameter.

A shrub of the forest understory, this species is found in lowland and premontane forests in eastern Panama and in Costa Rica from along the Pacific in Guanacaste to the Meseta Central and the Cordillera Talamanca north of San Isidro to elevations of 1300 m. Flowering collections have been made in December only.

*Aphelandra leonardii* can be recognized by its calyx, which is conspicuously longer than the bracts, its short (7 to 9.5 mm long), entire bracts with submarginal alveolate glands, and its long (ca. 7 cm), bright red corollas, which are externally papillate. It resembles *A. campanensis*, a largely Panamanian species that has been collected in adjacent areas of Costa Rica. (See the description of that species for a summary of differences.) It also resembles *A. lingua-bovis*, and these differences are summarized in descriptions of both this species and *A. campanensis*.

***Aphelandra lingua-bovis*** Leonard, Contr. U.S. Natl. Herb. 31: 268. 1953. Figure 2.

**Shrubs**, 1–3.5 m tall; stems terete or subquadrangular toward tips, **internodes** between leaf-bearing nodes 2–9 cm long, 3–5 mm thick, moderately and minutely strigose, the hairs upwardly appressed. Leaves petiolate, pet-

ioles to ca. 1 cm long, strigose; laminae oblanceolate to narrowly elliptic, to 38 cm long, 12 cm broad, apically acuminate and often curved to one side, basally attenuate, margins entire or undulate, glabrous to sparingly strigose above, hairs densest along the prominent costa and lateral veins, strigose to sparingly strigose below, lower surface drying to a lighter green than the upper. **Inflorescences** in terminal spikes, mostly solitary, spikes to 38 cm long, 1.2 cm broad; peduncle to 1 cm long, sericeous; rachis sparingly sericeous; **bracts** bright red when fresh, drying to reddish brown, rhombic-ovate, 10–14 mm long, 8–10 mm broad, apically acute to slightly obtuse, glabrous to puberulous with upwardly appressed hairs along the prominent costa, lateral veins also prominent, with 2 dull, elliptic, alveolate, submarginal glandular areas about midway from the base, to 3 mm long, 1 mm broad, margins ciliolate; bracteoles linear-lanceolate, to 15 mm long, 2 mm broad, apically acuminate, keeled, the keel densely hirsute with ascending hairs ca. 1 mm long. **Flowers** with the **calyx** ca. 17 mm long, the segments lanceolate, increasingly puberulous toward the apex, striate-nerved, the posterior segments 8 mm broad, the lateral segments 1.7 mm broad, the anterior segments 2.2 mm broad; **corolla** bright red, or reddish yellow, 5.5–6 cm long, puberulous, the tube subcylindric, slightly curved, 3.5 mm broad at the base, 6 mm broad at the throat, the upper lip erect, elliptic, 16 mm long, 7 mm broad, 2-lobed, the lobes apically acute, 4 mm long, 3 mm broad basally, the middle lobe of the lower lip lanceolate, 18 mm long, 6 mm broad, acute, the lateral lobes 4 mm long, partly coalescent to the upper lip, the free portions triangular, ca. 1.5 mm long, 1 mm broad, apically acute; **stamens** slightly exerted, anthers apiculate at both ends, webby-pilose at tip; ovary densely strigose, hairs ascending. **Fruits** clavate, 18–20 mm long, 4 mm broad, 3.5 mm thick, glabrous except for ascending strigose hairs toward the round apex, perianth persistent except the early deciduous corolla; seeds 4, dark brown, deltoid-shaped, ca. 5 mm long, 4 mm broad, margins sparingly tuberculate.

Found in mature rain forest of lowland areas in southwestern Costa Rica. Most collections are from the Golfo Dulce area at low elevation, although one collection, *Raven 22017* (F), has been made at Wilson's finca south of San Vito (San Vito de Java) at ca. 1300 m elevation. Flowering collections made from June through March. This species is also found in Panama and Colombia.

*Aphelandra lingua-bovis* is recognized by its long (to 38 cm), compact inflorescences with entire, bright red bracts (when fresh) with alveolate submarginal glands and large (ca. 6 cm long), puberulous, bright red corollas. It resembles *A. campanensis* and *A. leonardii*, which differ in their smaller inflorescences, papillose corollas, and either oblong or ovate (vs. clavate) capsules.

***Aphelandra scabra*** (Vahl) Sm. in Rees, Cyclopædia 39, *Aphelandra* n. 3(1818), based on *Justicia*

*scabra* Vahl, Enum. 1: 120. 1804. *Aphelandra deppeana* Schlecht. & Cham., Linnaea 5: 96. 1830. *A. pulcherrima* sensu H.B.K., Nov. gen. sp. 2: 236. 1817. *A. pectinata* Willd. ex Nees, DC., Prodr. 11: 298. 1847. *A. haenkeana* Nees, DC., Prodr. 11: 298. 1847. Figure 1.

**Shrubs** 1–3.5 m tall; young stems subquadangular to terete, glabrous to velutinous, leafy internodes 3–10 cm long, 2.5 mm thick, lenticels oval to linear, mostly less than 1 mm long. **Leaves** petiolate, petioles sessile to 5 mm long, strigose; laminae elliptic to 25 cm long, 8 cm broad, apically acuminate, basally attenuate, margins entire to undulate, glabrous to scabridulous above, strigose to velutinous beneath, especially on costa and lateral veins. **Inflorescences** in dense terminal spikes to 19 cm long, 1 cm broad excluding corollas; peduncle subsessile; rachis pilose; **bracts** imbricate to 15 mm long, 6 mm broad, apically acuminate, basally cuneate, strigose outside, puberulous inside, with 2 clusters of submarginal, mid-dorsal glandular areas with 1–10 ovular glands per area, each gland ca. 0.5 mm long, outside of bract rather strongly 5-nerved, with 4–8 marginal teeth to 1.5 mm long, margins ciliate; bracteoles lanceolate, to 6 mm long, 1.5 mm broad, keeled, velutinous along the keel. **Flowers** to 3 cm long, **calyx** segments lanceolate, to ca. 8 mm long, anterior segments ca. 1.5 mm broad, lateral segments ca. 1 mm broad, posterior segment ca. 3 mm broad, all segments puberulous toward apex; **corolla** pink, purplish red, scarlet or red, bilabiate, to 3 cm long, gradually expanding to 4 mm broad at the mouth, constricted to 2 mm broad just above the ovary, puberulous outside, glabrous inside, lips ovate, upper lip 2-lobed, to 1 cm long, each lobe acuminate, 3 mm long, lower lip slightly longer, acuminate at apex; **stamens** with hispid filaments, exerted. **Fruits** elliptic, to 15 mm long, 6 mm broad, 3 mm thick, apex acute, glabrous to sparingly puberulous; seeds 2 per locule, flattened, irregular in shape, ca. 3 mm broad, 1 mm thick, surface minutely roughened, dark brown.

This is a common and wide-ranging plant in shaded areas within mature tropical dry forests or old secondary forests, generally at lower elevations of the western coastal areas in Costa Rica, but also found in the Meseta Central region at elevations as high as 1100 m. This species grows from southern Mexico to northern South America. Flowering observed year round.

*Aphelandra scabra* is recognized by its pale green (when fresh) toothed bracts with two clusters of submarginal glands, smallish bracts (less than 16 mm long), short, reddish corollas (to 3 cm long), and its subsessile leaves. It bears a slight resemblance to *A. storkii*, which is easily distinguishable, with its longer bracts, longer orange corolla, and much longer petioles.

***Aphelandra seibertii* Leonard, Ann. Missouri Bot. Gard. 24: 205. 1937. Figure 2.**

**Herbs** to 19 cm tall; **stems** quadrangular, **internodes** between leaf-bearing nodes 0.5–1 cm long, 2–2.5 mm thick, pilose hairs to 1 mm long, lower stem rooting at the nodes. **Leaves** petiolate, petioles to 1.6 cm long, densely pilose; laminae elliptic, 4.5–9.5 cm long, 1.5–4.0 cm broad, apically acute, basally acute, margins entire to slightly undulate, pilose hairs to 1 mm long above and beneath, very dense along costa and lateral veins beneath. **Inflorescences** in 1–3 terminal spikes to 13 cm long, 1 cm broad excluding corollas; peduncles 3–5 cm long, densely yellowish pilose; rachis densely pilose; **bracts** closely imbricate, spreading at maturity, rhombic, to 14 mm long, 6 mm broad, tips often purplish, margins above midpoint dentate with 2–3 erect teeth per side, each ca. 1 mm long; bracteoles lanceolate, to 9.5 mm long, 2 mm broad, keeled, translucent, pilose along the keel. **Flowers** 15–20 mm long, falling away at maturity when bracts are expanded; **calyx** segments lanceolate, subequal, ca. 5 mm long, translucent, with small glandular hairs plus pilose hairs, posterior segment 1.4 mm broad, lateral segments 0.5 mm broad, anterior segments 0.7 mm broad; **corolla** yellow at base, lobes lavender-tipped, puberulous-glandular outside, glabrous inside, bilabiate, tube funnelform, 11 mm long, 2 mm broad at base expanding to 4 mm broad at mouth, upper lip 6.5 mm long, 5.5 mm broad, apex with 2 rounded lobes 2 mm long, lower lip 3-lobed, middle lobe retuse, 8 mm long, 5 mm broad, lateral lobes apically rounded, 6 mm long, 2 mm broad; **stamens** slightly exerted, filaments pilose. **Fruits** oblong-lanceolate, ca. 8 mm long, 3 mm broad, 1.5 mm thick, reddish brown; seeds 4, subtriangular, 3 mm long, 0.7 mm thick, puberulent.

Found in rain forests in deep shade in Costa Rica and Panama. Found in the Caribbean slope at lower elevations in Costa Rica. Flowers through most of the year.

*Aphelandra seibertii* is recognized by its low herbaceous habit, pilose stems and leaves, small leaves (mostly less than 10 cm long), toothed bracts, and corollas with yellow bases and purplish tips. This may be confused with *Justicia chamaephyton*, which can be distinguished from *A. seibertii* by its basally obtuse or rounded leaves, two stamens, less compact spikes, and smaller entire bracts.

***Aphelandra sinclairiana* Nees in Benth., Bot. voy. Sulphur 146. pl. 47. 1844. Figure 2.**

**Shrubs** or small trees to 6 m tall; younger stems terete to subquadangular at the apex, **internodes** between leaf-bearing nodes 1–4 cm long, 2–8 mm thick, velutinous. **Leaves** petiolate, petioles 1–2 cm long, pilose; laminae narrowly elliptic to near-ob lanceolate, to 30 cm long, 8.5 cm broad, apically acuminate, basally attenuate, margins entire to shallowly crenate, sparingly pilose above except at costa, pilose below. **Inflorescences** borne in terminal and subterminal spikes in clusters of as many as 10 spikes, spikes to 15 cm long, 2 cm broad excluding corollas; peduncles subquadangular, to 5.5 cm long, rachis velutinous; **bracts** orange-red, densely imbricate, obovate-

rhombic, 16–20 mm long, 14–20 mm broad, lowermost bracts apically acuminate, upper bracts often obtuse, 5–6 rather prominent nerves with branching toward apex of bract, puberulous to velutinous dorsally, puberulous ventrally, with 2 clusters of submarginal elliptic glands at about the middle of the dorsal surface, glands ca. 0.5 mm long, 0.25–0.4 mm broad, 2–10 glands per cluster, margins entire; bracteoles lanceolate to ovate-lanceolate, 6.5–7.5 mm long, 3–3.5 mm broad, striate, subcarinate, puberulous to tomentose outside, puberulous inside. Flowers 5.5–6.5 cm long; calyx segments lanceolate, the posterior segment 7–9 mm long, 3 mm broad, lateral and anterior segments 7–9 mm long, 1.5–2 mm broad, puberulous outside, glabrous inside, striate-nerved; corolla purplish red, bilabiate, short-velutinous outside, tube funneliform, 4.5–5 cm long, 3.5 mm broad at base, 6.5 mm at mouth, upper lip erect, to 18 mm long, 9 mm broad, 2-lobed, the lobes acuminate, keeled apically, to 7.5 mm long, the lower lip spreading, middle lobe lanceolate, keeled, to 25 mm long, 8 mm broad, lateral lobes triangular, connate to upper lip for most of their length, acute, free portion to 1.3 mm long, 1.5 mm broad; stamens exerted to just below the tip of the upper lip and enclosed by it. Fruits clavate, black, to 1.8 cm long, 6 mm broad, 3 mm broad at base, puberulent, apically obtuse; seeds 4, puberulent, flattened, ca. 3.5 mm in diameter.

According to McDade this species grows mainly in gaps in lowland rain forests extending to pre-montane forest and is also a successful colonizer in more extensively disturbed areas. In Costa Rica it has been collected mostly from such habitats in Limón Province, with a few older collections from Cartago and Heredia provinces. Flowering collections have been made from September through April.

*Aphelandra sinclairiana* is recognized by its large, obovate-rhombic bracts (16 to 20 mm long), which are orange-red and have two clusters of shiny, submarginal glands, its large (ca. 6 cm long), purplish red corollas, and its often relatively tall height (to 6 m). It is easily confused with *A. golfdulcensis*. (See the description of that species for a discussion of these differences.)

***Aphelandra storkii*** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1197. 1938. Figure 2.

**Shrub** to ca. 2 m tall; young stems quadrangular, terete shortly below terminus, internodes between leaf-bearing nodes 2–4.5 cm long, 2–3.5 mm thick, pilose toward the terminus. Leaves petiolate, petioles 1–3 cm long, hirsute to subglabrous; laminae elliptic to elliptic-obovate, to 44.5 cm long, 13.5 cm broad, apically acuminate, basally attenuate, margins serrulate to undulate, sparingly striate above, densely strigose below, the veins prominent. Inflorescences in terminal spikes to 18 cm long, 2.5 cm broad excluding corollas; peduncles quadrangular, to 2.5

cm long, hirsute, rachis quadrangular, hirtellous; bracts oblong-ovate, to 25 mm long, 13 mm broad, pilosulous, with 2 clusters of 15–20 submarginal elliptic glands just below midpoint of dorsal surface, glands ca. 0.5 mm long, 0.2 mm broad, margins ciliolate, with 2–3 pairs of teeth to 0.9 mm long near midpoint, one of which is frequently larger than the others; bracteoles lanceolate, to 10 mm long, 2 mm broad, apically acuminate, striate-nerved, pilosulous. Flowers to 7 cm long; calyx segments subequal, 12–13 mm long, posterior segment 4 mm broad, lateral and anterior segments 2 mm broad, all apically attenuate, pilosulous, striate-nerved; corolla orange, pilose, the tube funneliform, 3 mm broad at base, 7 mm broad at throat, upper lip erect, to 20 mm long, 12 mm broad, apically 2-lobed, lobes 11 mm long, apically keeled and attenuate, the middle lobe of the lower lip lanceolate, to 22 mm long, 9 mm broad, apically attenuate and curved back, lateral lobes triangular, connate to upper lip for most of their length, acute, free portion to 0.8 mm long, 0.9 mm broad, stamens exerted to just below the tip of the upper lip and enclosed by it; anthers to 8 mm long, 1 mm broad, apically adherent, basally acute; filaments glabrous. Fruits clavate, 25–28 mm long, 7–8 mm broad, 4–5 mm thick, glabrous; seeds 4, ovate, ca. 6 mm long, 5 mm broad, glabrous.

Found in lowland rain forest. Only one collection, Opler 988 (F, NY, MO) from La Selva near Puerto Viejo of Heredia Province, has been seen other than the type collection made at Livingston along the Río Reventazón in Limón Province. Flowering collections have been made in July and August.

*Aphelandra storkii* is recognized by its long (more than 2 cm) gland-bearing, toothed (two to three pairs) bracts, its long orange corolla (7 cm), and its relatively large, petiolate leaves. It bears a slight resemblance to *A. scabra*, which has shorter bracts, corollas, and leaves; its leaves are subsessile and its corollas are reddish, but not orange.

***Aphelandra tonduzii*** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1198. 1938. Figure 3.

**Herbs** to 16 cm tall, stems terete, pilose, internodes between leaf-bearing nodes 3–30 mm long, 2–4 mm thick. Leaves on pilose petioles 1–3 cm long; laminae elliptic to 18 cm long, 5.5 cm broad, apically acute to obtuse, basally attenuate, margins entire, pilose on both surfaces, more so on costa and lateral veins. Inflorescences of loose axillary spikes to 20 cm long, 0.5–1 cm broad excluding corollas; peduncle subquadrangular, pilose, plus occasional glandular hairs, rachis subquadrangular, pilose with numerous glandular hairs; bracts lanceolate, slightly keeled, 6–8 mm long, 1.25–1.5 mm broad, puberulous with occasional glandular hairs, margins ciliolate, often with a pair of minute, marginal teeth, bracts not imbricate at anthesis; bracteoles subulate, ca. 4.5 mm long, 0.6 mm broad, puberulous with occasional glandular hairs. Flowers to 13 mm long; calyx segments to 5 mm

long, posterior segment lanceolate, 1 mm broad, lateral and anterior segments subulate, 0.5 mm broad, all striate-nerved, puberulous toward tip; corolla white in bud, becoming purplish with age, bilabiate, tube to 8 mm long, 1 mm broad at base, 1.5 mm broad at mouth, glabrous outside, puberulous within, the 2 lobes of the upper lip obovate, 2.5 mm long, 1 mm broad, apically retuse, middle lobe of the lower lip rhomboid-ovate, 5 mm long, 5 mm broad, apically retuse, lateral lobes obovate, 4 mm long, 3 mm broad, apically retuse, minutely puberulous inside; stamens included, filaments sparingly puberulous, anthers bearing a tuft of hairs apically. Fruits clavate, ca. 8 mm long, 3 mm broad, glabrous; seeds 4, obovate, flattened, 3 mm long, 2.5 mm broad, 1 mm thick, surface hispidulous.

Found in cloud forest at and above 1000 m in Costa Rica and adjacent Panama. It has been collected over a wider range in Costa Rica, where most collections are from the Cordillera Central, and others are from the vicinity of San Isidro. Flowering collections have been made from October through February.

*Aphelandra tonduzii* is recognized by its small size (to 16 cm tall), its small (less than 8 mm), toothed, eglandular bracts, and its small flowers (to 13 mm long). Superficially, it can be confused with some forms of *Elytraria imbricata*, which differs in its smaller, entire, and more imbricate bracts, its smaller flowers (to 8 mm long), and its slenderly conical capsules, which lack hooklike funicles. *Aphelandra tonduzii* also resembles *A. arnoldii* of Colombia and Panama, which differs with its eglandular rachis and red flowers.

#### *Aphelandra tridentata* Hemsl., Biol. cent.-amer., Bot. 2: 513. 1882. Figure 3.

**Herb to subshrub**, erect, to 2 m tall; young stems quadrangular, internodes between leafy nodes 1–6 cm long, 2–5 mm thick, pilose to woolly. Leaves petiolate, petioles to 3.0 cm long, pilose to strigose; laminae elliptic to elliptic-oblong, 10–18 cm long, 2.5–3 cm broad, apically acuminate, basally attenuate, margins entire to undulate, strigose to glabrous above, strigose below, upper surface drying to pale green, lower surface to dark green. Inflorescences in solitary, dense terminal spikes to 11 cm long, 3 cm broad excluding corollas; peduncle quadrangular, to 13 mm long, woolly, rachis quadrangular, woolly; bracts oblong-lanceolate, green, 3.5–4 cm long, 0.5–1.5 cm broad, sericeous, margins entire with 1–2 pairs of teeth above the midpoint, one conspicuously larger than the rest, to 3.5 mm long; bracteoles linear, to 13 mm long, 1.3 mm broad, apically acuminate, striate-nerved, sericeous. Flowers 5–6.5 cm long; calyx segments lanceolate, to 11 mm long, puberulous, striate-nerved, posterior segment 3.5 mm broad, lateral segments 1.5 mm broad, anterior segments 2.5 mm broad; corolla bright

red, puberulous, the tube 4 mm broad at base, narrowing to 2 mm just above the ovary, gradually enlarging to 7 mm broad at the mouth, the upper lip erect, elliptic, to 25 mm long, 8 mm broad, apically keeled, lower lip 3-lobed, middle lobe ovate, to 25 mm long, 17 mm broad, apically obtuse, lateral lobes oblong-obovate, to 15 mm long, 6 mm broad, apically rounded; stamens exserted to just below tips of upper lip, anthers lemon yellow, 6.5 mm long, 1 mm broad, apically acuminate with pilose hairs, basally acute; filaments sparingly puberulous. Fruits ovate, ca. 15 mm long, 6.5 mm broad, apically apiculate, glabrous, shiny, perianth except corolla persistent; seeds orbicular, ca. 4 mm broad, surface covered with tubercles.

Found in cloud forests and forest clearings from the San José area to Monteverde in Guanacaste at elevations of 850–1600 m. Flowering collections have been made from September through December.

*Aphelandra tridentata* is recognized by its long (2.5 to 3 cm), eglandular bracts with one or two pairs of teeth and its long (5 to 6.5 cm), bright red corollas; it is found at higher elevations (above 850 m). Older inflorescences lacking flowers could be confused with *A. dolichantha*, which has less compact inflorescences and also differs in its lack of toothed bracts and its longer (6.5 to 7.2 cm), white corollas; it occurs between sea level and 1000 m.

#### *Asystasia* Blume

**Herbs or shrubs.** Leaves entire, petiolate, with abundant cystoliths when mature. Inflorescences of secund spikes or racemes, these loose or compact, simple or branched. Flowers solitary on short pedicels, subtended by 2 small bracts and 2 bracteoles of ca. equal size; calyx 5-merous, segments linear or lanceolate; corolla white, blue, purple, rose, or yellow, tube short to funnelform, 5 lobes, subequal; stamens 4, didynamous; anthers oblong with 2 parallel cells, calcarate or muticous at base; ovary 4-ovulate, pubescent; stigma minutely 2-parted or subcapitate; capsules elliptic, 2–4 seeded; seeds compressed, orbicular or irregularly angled, glabrous.

This genus is not native to the Neotropics. According to Leonard (1951) about 70 species have been described which are mostly from tropical Africa, Asia, and the East Indies.

*Asystasia* resembles the genus *Dyschoriste* with which it shares most characteristics including the few pollen grains that have been examined. They differ in inflorescences, with *Dyschoriste* having

flowers borne in cymose fascicles or singly at the axils.

**Asystasia gangetica** (L.) T. Anders in Thwaites, *Enumeratio plantarum zeylaniae* 235. 1859–1864. *Justicia gangetica* L., *Amoen. acad.* 4: 299. 1759. Figure 3.

**Herbs**, ascending, to ca. 30 cm tall; stems quadrangular, **internodes** between leaf-bearing nodes 4.5–7.5 cm long, 1–2 mm thick, pilose. **Leaves** petiolate, petioles to 11 mm long, sparingly strigose; laminae ovate to deltoid, 3.5–5 cm long, 2–2.5 cm broad, apically acuminate, basally obtuse to truncate, margins crenulate to entire, subglabrous to sparingly pilose especially on the veins above and below, numerous cystoliths visible only on the upper surface. **Inflorescences** in terminal, mostly second racemes, to 13.5 cm long; flowers on short pedicels to 2 mm long; 4 bracteoles in 2 series subtending each flower, lanceolate, to 2 mm long, pilose. **Flowers** to 4 cm long; **calyx** and pedicel pilose with numerous glandular hairs, calyx lobes lanceolate, 5–7 mm long; **corolla** yellow with purplish throat, funnelform, 3.5 mm broad at base, 10 mm broad at throat, lobes semioblique, ca. 10 mm broad with numerous minute glandular hairs outside, glabrous within, **stamens** included; anther cells each mucronulate apically and basally, 3 mm long, 1 mm broad; **ovary** 3.5 mm long, style 21 mm long, velutinous, stigma 2-lobed. **Fruit** oblong, to 13 mm long, 2 mm broad; perianth persistent except early deciduous corolla; with 2–4 flat, oval seeds ca. 1 mm long, 0.75 mm broad, oblique at point of attachment, edged with dense mucilaginous hairs when wet.

Found in cultivation or as an escape in Costa Rica and much of tropical America. Native to tropical Africa, Asia, and Malaya. In Costa Rica and Panama, it is found from near sea level to ca. 1000 m altitude. Flowering collections have been made in March, April, and May.

*Asystasia gangetica* is recognized by its one-sided racemes with large (to 4 cm long), funnelform corollas, which are yellow with purplish throats, and its minute bracteoles (2 mm long).

#### **Barleria** L.

**Shrubs or herbs**, erect, sometimes spiny. **Leaves** opposite, petiolate to near sessile; laminae entire, cystoliths generally prominent and dense on both surfaces. **Flowers** axillary or borne in dense terminal bracted spikes; **calyx** deeply 4-lobed, lobes unequal; **corolla** 5-merous, the broad, spreading lobes mostly subequal; **stamens** 4, di-dynamous, adnate to base of corolla tube, generally all stamens perfect, but American species with only 2 perfect stamens plus 2 staminodes. **Fruits** ovate to oblong, flattened, with 2 seeds per locule; seeds flattened, ovate to suborbicular.

More than 100 species of this genus have been described, and nearly all of them occur in the Old World Tropics.

**Barleria micans** Nees in Benth., *Bot. voy. Sulphur 146.* 1844. *B. discolor* Nees in Benth., loc. cit. Figure 3.

**Herbs** with erect stems to 75 cm tall; **internodes** between leaf-bearing nodes 1.6–6.2 cm long, 1.5–4 mm thick, stems strigose, hairs appressed, to 1 mm long, cystoliths prominent and dense, 0.3 mm long. **Leaves** petiolate, petioles to 1.5 cm long, strigose; laminae lanceolate to oblanceolate, 5.5–23 cm long, 1.5–5.2 cm broad, apically acuminate, basally attenuate, margins entire, sparsely strigose above with cystoliths, strigose below, cystoliths few, trichomes densest on veins and margins, bluish along costa upon drying. **Inflorescences** in dense terminal spikes to 7 cm long, 3 cm broad excluding corollas, subsessile; **bracts** ovate, to 3.5 cm long, 1.5 cm broad, apically acuminate, basally acute, chartaceous, costa prominent, sericeous inside, strigose outside plus occasional glandular hairs, midvein and base of each side velutinous, often bluish upon drying, margins of spiny hairs to 2 mm long; bracteoles oblanceolate, to 2 cm long, sericeous with simple and glandular hairs, margins ciliate. **Flowers** sessile, to 4.5 cm long; **calyx** segments unequal, anterior segment elliptic, to 2.5 cm long, 1 cm broad, apically bidentate, margin with spines to 2 mm long, lateral segments lanceolate, to 2 cm long, 2 mm broad, apically aristate, sericeous, posterior segment slightly longer and narrower than the anterior segment, apically acuminate, margin with spines to 2 mm long; **corolla** yellow, drying purple, bilabiate, the tube to 3 cm long, slender, 4 mm broad at base, lobes subequal, obovate, ca. 1.5 cm long, 6 mm broad, apically rounded, upper lip of 1 lobe, lower lip of 4 lobes; **perfect stamens** 2, exserted, anthers 2-celled, 5 mm long, filaments glabrous, to 4 cm long, imperfect stamens reduced to staminodes ca. 0.2 mm long, staminodes with a centrally located spur; **ovary** pandurate, ca. 5 mm long, style ca. 4.2–4.5 cm long, glabrous, stigma cylindrical, to 1 mm long. **Fruits** elliptic to 2 cm long, 1.6 cm broad, 2 mm thick, apically acuminate, dark purple-brown when dry, the 4 seeds irregularly ovate, ca. 5 mm long, 0.3 mm thick, velutinous.

Found in dry forest regions of all provinces in the Pacific watershed from near sea level to about 600 m of the western Meseta Central. Flowering collections made from December to April. This species ranges from west-central Mexico to Colombia.

*Barleria micans* is recognized by its dense terminal spikes with large, conspicuous, overlapping bracts with spiny margins, these often turning dark bluish upon drying, and its conspicuous yellow (drying to purple), subequal flowers to 4.5 cm long. This species is slightly similar to *Aphelandra au-*

*rantiaca*, but close examination will show all *Aphelandra* species to have four fertile stamens instead of two and bilabiate flowers.

### Blechum P. Browne

Perennial herbs or shrubs. Leaves petiolate; laminae lanceolate to ovate, entire, undulate, crenate, or serrulate, containing numerous cystoliths on both surfaces. Inflorescences in dense terminal, quadriflorous spikes. Flowers 5-merous, calyx segments subequal, linear-subulate; corolla white, blue, lavender or purplish, funneliform with narrow tube, lobes subequal, bracts 1 per flower, imbricate, ovate-oblong to ovate-deltoid; brac-

teoles 2, linear, oblanceolate or lanceolate; stamens 4, didynamous, cells of anthers parallel and equal. Fruits of elliptic capsules, flattened, dissepiment breaks away from capsule wall at maturity, seeds few to 16, reddish brown, flattened, ca. 2 mm in diameter, edges with a band of sticky, dense, mucilaginous hairs when wet, glabrous when dry.

Native to tropical America, although species such as *B. brownei* are reported from other tropical areas as well. Leonard (1951) states that this genus consists of about six tenable species and that there is a close relationship between *Blechum* and *Ruellia*, but *Blechum* can be recognized by its dense, four-sided spikes and very small flowers.

### Key to Species of *Blechum*

- 1a. Corolla small, equally or barely exceeding the bracts; bracts acute at apex ..... *B. brownei*
- 1b. Corolla relatively large, twice as long as the bracts or longer; bracts acuminate at apex .....  
*B. costaricense*

***Blechum brownei*** Juss., Ann. Mus. Natl. Hist. Nat. 9: 270. 1807. 1918. *Ruellia blechum* L., Syst. nat. 10, 2: 1120. 1759. *Barleria pyramidata* Lam., Encycl. 1: 380. 1783. *Blechum pyramidatum* (Lam.) Urb. in Repert. Spec. Nov. Regni Veg. 15: 323. 1918. *Blechum brownei* f. *puberulum* Leonard, J. Wash. Acad. Sci. 32: 942. Figure 3.

Herbs with erect to declining stems to 50 cm tall; younger branches quadrangular, appressed-puberulent, internodes between leaf-bearing nodes 1.2–7 cm long, 1–2 mm thick. Leaves petiolate, petioles to 14 mm long, puberulent; laminae ovate to ovate-lanceolate, 2–6.5 cm long, 1–3 cm broad, apically acute, basally cuneate to obtuse, margins crenate to entire, both surfaces sparsely pilose to glabrous, numerous cystoliths. Inflorescences in terminal spikes, 4-sided, 1.5–7 cm long, peduncles to 1.5 cm long, appressed-puberulent; bracts ovate, 7.5–14 mm long, 6–11 mm broad, apically acute, basally rounded, loosely strigose and densely puberulous, margins ciliate; bracteoles lanceolate, 5 mm long, 1 mm broad, ciliate; calyx segments 3 mm long, 0.5 mm broad, ciliolate; corolla white turning pale pink and lavender with age, 10–15 mm long, slightly longer than the subtending bract. Fruit obovate, ca. 6 mm long, 3 mm broad, 1 mm thick, apically acuminate, puberulous, perianth persistent except the early deciduous corolla; seeds 16, suborbicular, 1 mm in diameter.

Found as a weed in disturbed areas along riverbanks, roadsides, lawns, and pastures; flowering year-round, it occurs in all parts of Costa Rica

below 1400 m elevation. Ranging from eastern and west-central Mexico through Central and South America to the West Indies, Guam, Taiwan, and the Phillipine and Caroline islands.

*Blechum brownei* is recognized by its four-sided, terminal spikes, its apically acute bracts, and its small flowers, which barely extend beyond the bracts. Closely resembling *B. costaricense*, it can be distinguished from it by its shorter flowers and acute bracts; it usually grows in a more disturbed, open habitat. Commonly called *Sornia*, it is used as a folk remedy in Costa Rica and Panama in the form of a tea to relieve amoebic and probably other types of dysentery.

***Blechum costaricense*** Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 168. 1855. *Blechum dariense* Lindau, Repert. Spec. Nov. Regni Veg. 12: 423. 1913. Figure 3.

Herbs to suffrutescent at the base in older forms, to 1.1 m tall; young stems quadrangular, pilose, internodes between leaf-bearing nodes 2.2–6.5 cm long, 1–2 mm thick. Leaves with petioles to 2 cm long, pilose; laminae ovate to ovate-lanceolate, 2–11 cm long, 1–5 cm broad, apically acuminate, basally attenuate, margins undulate or serrulate, both surfaces pilose to sparingly pilose, numerous cystoliths visible on both surfaces. Inflorescences in terminal spikes, 4-sided, to 5.5 cm long, peduncles to 2 mm long, pilose; bracts ovate-deltoid, apically cuspidate or acuminate, basally rounded, to 2 cm long, 1.5

cm broad, sparingly pilose outside and inside, margins ciliate; bracteoles linear to oblanceolate, 7–10 mm long, 0.5–1 mm broad, pilose margins, ciliate; **calyx** segments equal, ca. 5 mm long, 0.75 mm broad at base, ciliate; **corolla** 2–2.5 cm long, pale lavender to purple, extending well beyond the subtending bract. **Fruit** elliptic, ca. 8 mm long, 5 mm thick, apically acuminate, perianth persistent except the soon deciduous corolla; seeds suborbicular, ca. 2 mm in diameter.

Found in Costa Rica in rain forests of the Caribbean watershed area, the Pacific slopes of Valle del General area to the Cordillera Tilarán, at elevations of 200 to 1000 m. This species is also found rather commonly in adjacent areas of Panama to sea level and in lowland areas in the Canal Zone. Flowering collections have been made from September through March.

*Blechum costaricense* is recognized by its four-sided, terminal spikes, its broad, acuminate bracts, and its corollas, which are twice as long as the bracts. Closely resembling *Blechum brownei*, it can be distinguished by its larger flowers and acuminate bracts.

#### **Bravaisia** DC.

**Shrubs or trees.** Leaves petiolate; laminae ovate to elliptic, apically acute to acuminate, margins entire to slightly undulate. **Inflorescences** terminal in compact, leafy panicles. Flowers subtended by a pair of bracts; **calyx** 5-merous, subcoriaceous; **corolla** white, yellow, or purplish with a short tube and campanulate throat, 5 lobes, subequal; **stamens** 4, anther cells 2, contiguous, spurred at the base. **Fruit** a capsule with 4–8 seeds.

A genus of the Neotropics, *Bravaisia* has five species variously reported from Mexico, Central America, Colombia, Venezuela, Peru, and the West Indies.

**Bravaisia integerrima** (Spreng.) Standley, Contr. U.S. Natl. Herb. 23: 1335. 1926. *Amazonia integerrima* Spreng., Syst. veg. ed. 16. 2: 765. 1825. *Onchyacanthus speciosus* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 131. 1855. Figure 4.

Tree to 20 m tall; branchlets quadrangular, **internodes** between leaf-bearing nodes 2.5–7 cm long, 2.5–5 mm thick, glabrous to tomentose on youngest portions. Leaves with petioles to 4 cm long, pubescence of petioles like

that of the stem; laminae ovate to ovate-elliptic, 3.5–28.5 cm long, 1–11.8 cm broad, apically acute or acuminate, basally acute or oblique, margins entire to slightly undulate, subcoriaceous, surfaces glabrous, sparingly pilose at costa and lateral veins. **Inflorescences** in leafy, compact, terminal panicles, to 13 cm long, 25 cm wide, peduncles quadrangular. **Flowers** subtended by oval bracteoles which are ca. 2 mm long, apically obtuse, puberulent and ciliolate; **calyx** segments subequal, spatulate, 5–6 mm long, 2–3 mm broad, puberulous and ciliolate; **corolla** white or yellow with a purple spot in the throat, 1.5–2.0 cm long, glabrous, tube campanulate, ca. 8 mm broad at the mouth, the limb ca. 2 cm across, lobes rounded or emarginate, ca. 10 mm long, 6–8 mm broad. **Fruits** clavate, flattened, 10–12 mm long, 4–5 mm broad, 3 mm thick, glabrous, perianth persistent; seeds 8, orbicular, 3.5 mm in diameter.

Plants of evergreen and deciduous forest formations, ranging from 100 to 600 m in the Pacific coastal regions to the Meseta Central and the Llanura de San Carlos. Flowering collections have been made from December through May. The species ranges from Peru, Colombia, Venezuela, and north to Oaxaca and Tamaulipas, Mexico.

*Bravaisia integerrima* is exceptional among the Acanthaceae for its large size. In addition to its large size, it is recognized by its flowers with four stamens having anthers with basal spurs. It also has eight-seeded capsules. It most closely resembles another woody species, *Trichanthera gigantea*, which has anthers with rounded bases and four-seeded capsules. Commonly called *palo de agua* in Costa Rica, it has a light-colored wood that is suitable for packing boxes and food pails. Numerous aerial roots similar to mangroves are often produced at the bases of the trunks (Leonard, 1951).

#### **Buceragenia** Greenman

**Herbs;** stems erect. Leaves petiolate; laminae usually ovate or elliptic. **Inflorescences** spicate or spicate panicles, the **flowers** solitary or in clusters; **bracts** and bracteoles minute; **calyx** 5-merous, segments linear, subequal; **corolla** tubular, shallowly bilabiate, posterior lip in-curved, emarginate or 2-lobed, anterior lip erect or slightly spreading, 3-lobed; **stamens** 2, inserted at middle of corolla tube, included; anthers usually 1-celled, the lower cell aborted or vestigial and sterile, if fertile, always considerably smaller; staminodes 2; **fruits** a clavate capsule, stipe narrow; seeds 4, flattened, suborbicular.

This is a genus of four species which extend from Mexico to Costa Rica.

**Buceragenia glandulosa** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1205. 1938. Figure 4.

**Herbs** to 1.5 m tall, **stem** erect, branching, subquadangular, glabrous to sparingly puberulous; **internodes** between leaf-bearing nodes 1.5–4 cm long, 2.5–3 mm thick. **Leaves** with petioles to 3 cm long, those subtending inflorescences subsessile, pubescence like that of the stem; laminae ovate to ovate-oblong, 5.5–18 cm long, 2–7.5 cm broad, apically acuminate, basally attenuate except the leaves immediately subtending the inflorescence which are basally rounded to cordate, margins entire, costa often reddish purple, glabrous. **Inflorescences** in terminal and axillary spikes or spicate panicles to 20 cm long, **flowers** sessile or nearly so, borne in fascicles of 2–4 or occasionally singly; **bracts** subulate, 1.5 mm long, 0.5 mm broad, glabrous, bracteoles similar, but smaller; rachis glandular-puberulous; **calyx** 5-merous, 3 mm long, lobes subulate, 2 mm long, 0.5 mm broad at base, glabrous; **corolla** small, tubular, glabrous, 3–3.5 mm long, 1 mm broad, lobes 5, more or less equal, suborbicular, 0.5 mm long, 0.25 mm broad, **stamens** 2, included, 1 mm long, anthers usually 1-celled, other cell usually aborted or vestigial and sterile, if fertile, always much smaller, 1 or both cells mucronate. **Fruits** clavate, 13–19 mm long, glabrous, stipe 6.5–10 mm long, 1.5 mm broad, expanded portion 6.5–9 mm, 2.5 mm broad, seeds flat, oval, 3 mm long, 2 mm broad, roughened.

Found in cloud forests at 1200 to 1800 m, this species is reported from Mexico, Guatemala, Nicaragua, and Costa Rica. Only three collections have been observed from Costa Rica, all from Cartago Province: *Holway 400* (us, holotype), *Standley 33686* (us), and *Standley 35503* (us). All collections were made in January or February, and all were in both fruit and flower.

*Buceragenia glandulosa* is recognized by its herbaceous habit with terminal and axillary spikes or spicate panicles, glandular-puberulous rachises, inconspicuous flowers in clusters of two to four or occasionally single, small, five-merous, mostly equal corollas 3 to 3.5 mm long with two stamens and two staminodes, anthers two-celled, with one cell usually aborted or vestigial, sterile, and much smaller; leaves immediately subtending the inflorescence sessile with ovate laminae and rounded to cordate bases. It resembles *Pseuderanthemum cordatum*, but is distinguished from it by its minute flowers and inflorescences with glandular-puberulous rachises (vs. puberulous). It also resembles *P. cuspidatum*, but may be distinguished from it by its minute flowers which occur in fascicles (vs. solitary flowers which are much larger).

### **Carlowrightia** Gray

REFERENCES—A. Gray, Contributions to the botany of North America. Proc. Amer. Acad. Arts

13: 361–374. 1878. T. F. Daniel, *Carlowrightia* (Acanthaceae). Flora Neotropica 34: 1–116. 1983.

**Subshrubs** and suffrutescent herbs. Leaves opposite, sessile to petiolate; laminae linear to ovate, entire. **Flowers** in axillary clusters or more commonly in spicate panicles. Flowers with a 5-merous calyx; **corollas** 4-parted, ranging from nearly regular to strongly zygomorphic, the lower lobe somewhat keeled and containing the anthers and style in bud, upper lobe spatulate and banner-like, often marked with a distinctively colored eye and/or radiating nerves; **stamens** 2, these follow the lower lip out the corolla tube, anther 2-celled with the cells equal and nearly parallel, opening toward the upper lip. **Fruits** with flattened stipes, compressed-ovoid, acuminate heads; seeds usually 4, ovoid, disklike, smooth, muricate to tuberculate, apically rounded and basally obliquely notched.

This is a genus endemic to the New World, with 20 species ranging from the southwestern United States to Costa Rica.

**Carlowrightia arizonica** A. Gray, Proc. Amer. Acad. Arts 13: 361–374. 1878. *Carlowrightia costaricana* Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1206. 1938.

Erect, suffrutescent plants to ca. 60 cm tall; **internodes** between leaf-bearing nodes 2–4 cm long, 3.5–4.5 mm thick, terete or subterete, retrorse pubescence. Leaves with short, puberulous petioles 2–6 mm long; laminae ovate, 3–4.5 cm long, 1.1–2.3 cm broad, apically acuminate, basally obtuse to rounded, margins entire to undulate, puberulous above and beneath, cystoliths visible on both surfaces, more obscure below. **Inflorescences** in lax terminal and subterminal spicate panicles, rachis puberulous; **flowers** sessile, mostly 1 per node, but occasionally 2 per node and opposite or 2 per bract; **bracts** and bracteoles subulate, 2–2.5 mm long, 0.5 mm broad, puberulous. Flowers with subulate, puberulous calyx segments, 1.2–1.5 mm long, ca. 0.5 mm broad; **corolla** bilabiate, puberulous, 9–15 mm long, ca. 1 mm broad basally, drying purplish, white with a yellowish eye bordered by purplish radiating lines on the upper lobe, narrowly oblong lobes twice the length of the tube; **stamens** exserted. **Fruits** clavate, 9–10 mm long, ca. 3 mm broad, 1 mm thick, apically attenuate, the slender stipe ca. half the length of the fruit, capsule dark purple or black when dry, glabrous; seeds 4, cordate, ca. 3 mm long, 2.8 mm broad, drying purplish, papillose.

This species extends from Texas and Arizona to Costa Rica. Only one collection from Costa Rica has been observed, *Standley & Valerio 44890* (us). This was in dry forest in the vicinity of Liberia, Guanacaste, at an elevation of 260 to 360 m. Flowering during January. In other areas it is

often found in rocky thickets with dry soil at similar elevations.

*Carlowrightia arizonica* is recognized by lax spicate panicles, bilabiate corollas with exserted stamens that have near equally attached anther cells, dark purple or black capsules when dry that have a narrow stipe nearly equal to half the capsule length, and short-petioled leaves. It may be confused with either *Justicia comata* or *Justicia petiolaris*, but these differ in their superposed anther cells and inflorescences with glandular puberulous rachises.

### **Chaetochlamys Lindau**

**Herbs** to suffrutescent plants. Leaves petiolate; laminae ovate to lanceolate. Flowers borne in short spikes that are crowded into a terminal, congested head; **bracts** and bracteoles narrow; **calyx** segments 5, equal, narrow; **corolla** salverform, bilabiate, upper lip 2-lobed, lower lip 3-lobed; **stamens** 2, exserted, anthers 2-celled, cells attached at different heights, the lower cells spurred. Fruits a clavate capsule; seeds 4.

*Chaetochlamys* is native to the Neotropics, with at least seven species known from South America and Central America.

### **Chaetochlamys panamensis** Lindau, Repert. Spec. Nov. Regni. Veg. 11: 124. 1912.

**Herbs** to 60 cm tall; stems branching, erect or decumbent, sometimes rooting at lower nodes, internodes between leaf-bearing nodes 2–4 cm long, 1–1.5 mm thick, terete, glabrous to puberulous along 2 lines. Leaves with petioles subsessile to 3 mm long, petioles puberulous to glabrous; laminae lanceolate-elliptic, 2.5–10.5 cm long, 1.1–3.2 cm broad, apically acuminate, basally attenuate, margins entire to undulate, cystoliths dense, prominent on both surfaces, glabrous to sparingly puberulous along costa and veins. Inflorescences in terminal heads, sessile; **bracts** linear, to 22 mm long, 0.75 mm wide, ciliate, the hairs to 1.5 mm long; bracteoles similar, but shorter and narrower. Flowers sessile; **calyx** segments lanceolate, 10 mm long, 1.5 mm wide, ciliate; **corolla** pink or purplish, sparingly glandular-puberulous, to ca. 4 cm long, the tube cylindrical ca. 22 mm long, 4 mm broad, the upper lip oblong, 10 mm long, 3 mm broad, apically 2-lobed, the middle lobe orbicular, 10 mm in diameter, the lateral lobes elliptic, 12 mm long, 8 mm broad; **stamens** exserted to just above the mouth, anther cells unequal, inserted at different heights, the upper cell 2 mm long, basally acute, lower cells 2.5 mm long, basally subcalcarate, the connective ca. 1 mm broad. Fruits stout-clavate, 11–12 mm long, 4.5–5 mm broad, 2 mm thick, glabrous, perianth persistent except the early deciduous corolla; seeds 4, suborbicular, not flattened, 2–2.5 mm in diameter.

Plants of deciduous forest formations in the Pacific coastal area at elevations of near sea level to 1000 m in Tilarán and San Ramón and one collection from near the Panamanian border in Limón Province, Hazlett 5207 (f). Also found in similar habitats of Panama. Flowering collections have been made from December through March.

*Chaetochlamys panamensis* can be recognized most easily by its inflorescences in sessile, terminal heads with conspicuous ciliate, linear bracts. It most closely resembles *Chaetothylax leucanthus*, but can be distinguished from it by its longer corolla (more than 20 mm long vs. 15 mm), five-parted calyx (vs. four-parted), and longer capsules (11 to 12 mm long vs. 6 mm).

### **Chaetothylax** Nees

**Herbs.** Leaves petiolate; laminae ovate to elliptic. Flowers more or less secund, borne in short, dense terminal and axillary spikes which often form panicles; **bracts** narrow with filiform tips, puberulous with ciliate margins; **calyx** 4-merous, segments resembling the bracts; **corollas** white to purplish, puberulous, bilabiate, lips subequal, upper lip narrowly ovate, lower lip deeply 3-lobed, the lobes rounded; **stamens** 2, slightly exserted, not exceeding the corolla lips, anthers 2-celled, upper cell oblong, lower cell reduced or vestigial or, as in the type species, hairlike, the lobes separated by a slender filiform connective. **Fruit** a clavate capsule; seeds 4, puberulous or puberulous.

*Chaetothylax* is native to the Neotropics, occurring in Central and South America. There are at least eight species known.

### **Chaetothylax leucanthus** Leonard, Contr. U.S. Natl. Herb. 31: 663. 1958. Figure 4.

**Herbs** to 60 cm tall; stems erect, terete with retrorse hairs along 2 lines, internodes between leaf-bearing nodes 1.5–3 cm long, 1–1.5 mm thick. Leaves with petioles short, to 5 mm long, strigose; laminae ovate-elliptic to elliptic, 2–10 cm long, 0.8–2.8 cm broad, apically cuspidate, basally attenuate, margins entire to crenate, glabrous above, cystoliths dense and prominent above. Inflorescences in compact, headlike terminal and axillary spicate panicles, spikes to 4 cm long, 1 cm wide, spikes dense, more or less 1-sided; panicles subtended by small leaves; **bracts** narrowly subulate, to 9 mm long, 0.5 mm broad, ciliate and moderately puberulous. Flowers with 4-merous **calyx**, segments narrowly subulate, to 11 mm long, ca. 0.4 mm wide, ciliate and minutely glandular-puberulous; **corolla** white, ca. 14 mm long, puberulous except at base, the tube cylindrical, 9 mm long, 0.5 mm broad, the upper lip ovate-oblong, 3.5 mm long, 1 mm

broad, apically emarginate, the lower lip 3-lobed, ca. 3.25 mm long, the lobes oblong, 2 mm long, the middle lobe 1.5 mm broad, the lateral lobes 1.25 mm broad, all apically obtuse; **stamens** exserted ca. half the length of the upper lip, the upper anther cell 0.75 mm long, lower cell attached 0.5 mm below the upper cell, reduced, sterile, filaments glabrous. **Fruit** clavate, 6 mm long, 1 mm broad, 2 mm thick, puberulous, perianth persistent; seeds 4, orbicular, slightly flattened, 1 mm in diameter, 0.5 mm thick, puberulous.

Plants of clearings, roadsides, and trails in deciduous forest formations in Guanacaste and Alajuela from near sea level to 500 m elevation. While only two collections (both by *Brenes s.n.*) have been observed from Costa Rica, it is assumed that this species is more common than this low number suggests, since it is rather inconspicuous and can easily be mistaken for another species which is more frequently collected.

*Chaetothylyax leucanthus* can be recognized most easily by its inflorescences in sessile, headlike pan-

icles. It is easily mistaken for *Chaetochlamys panamensis*, but can be distinguished from it by its shorter corolla and capsule and its four-parted calyx.

### **Chamaeranthemum** Nees

**Herbs or small shrubs.** Leaves petiolate to sessile; laminae lanceolate to ovate-lanceolate, entire to undulate, cystoliths dense and prominent on both surfaces. **Inflorescences** in loose terminal spikes or spicate panicles. **Flowers** sessile or pedicellate, 5-merous with inconspicuous bracts and bracteoles; **corolla** salverform, lobes subequal; **stamens** 4, included, anterior stamens with 2-celled anthers, posterior stamens with 1-celled anthers or sterile; **capsules** 2-4 seeded, with a long, narrow stipe.

*Chamaeranthemum* is native to tropical America with eight species reported from Costa Rica and northern South America.

#### **Key to Species of Chamaeranthemum**

- 1a. Leaves, stems, and rachises hirsute ..... *C. durandii*  
1b. Leaves, stems, and rachises glabrous ..... *C. tonduzii*

**Chamaeranthemum durandii** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1208. 1938. Figure 4.

**Herb** to 56 cm tall; younger stems quadrangular, older stems terete, **internodes** between leaf-bearing nodes 2.5-7.5 cm long, 1-1.5 cm broad, hirsute. **Leaves** petiolate to sessile, petioles to 6 mm long, pubescence like that of the stem; laminae ovate-lanceolate, 4.5-10 cm long, 1.6-4.5 cm broad, apically acuminate, basally rounded to obtuse, margins entire to undulate, sparingly pilose above, pilose below, cystoliths dense and prominent on both surfaces. **Inflorescences** of loose terminal spicate panicles, to 15 cm long, pubescence of peduncle and rachis that of the stem plus minute puberulence; **bracts** and bracteoles subulate ca. 1.5-2.0 mm long, 0.5 mm broad, puberulous. **Flowers** sessile, to 2 cm long; calyx segments linear-subulate, 2.5-3 mm long, 0.5 mm broad, puberulous-glandular; **corolla** pink or lavender, tube salverform, puberulous-glandular, 10-12 mm long, ca. 1 mm broad, expanding to 1.5 mm broad at midpoint, lobes 5, subequal, oblong, ca. 8 mm long, 5 mm broad, apically rounded; **stamens** 4, included, anthers of anterior stamens 2-celled, ca. 1.5 mm long, 0.5 mm broad, apically and basally acute, filaments short, 1 mm long, glabrous, posterior stamens sterile, 1.1 mm long. **Fruits** clavate, 15 mm long, 3 mm broad, 2 mm thick, apically apiculate, puberulous; seeds 2-4, flattened, suborbicular, ca. 2 mm in diameter, slightly winged, glabrous.

Found in Costa Rica in the shade of both tropical moist and wet forests of the Pacific watershed ranging from Valle del General and Valle del Diquis to Quepos at elevations of 30 m to ca. 800 m. Flowering collections have been made from January, February, and March.

*Chamaeranthemum durandii* can be recognized by its lavender corollas with five equal lobes and a narrow cylindrical tube with four short, included stamens, the posterior pair being sterile. It can be distinguished from *C. tonduzii* by its hirsute leaves, stems, and rachises.

**Chamaeranthemum tonduzii** Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica 9: 188. 1898, and in Pitt., Prim. fl. costaric. 2: 303. 1900.

**Herb** to 42 cm tall; younger stems quadrangular, older stems terete, **internodes** between leaf-bearing nodes 1.6-4 cm long, 1 mm broad, puberulous along 2 lines. **Leaves** petiolate to sessile, petioles to 5 mm long, pubescence like that of the stem; laminae lanceolate to lanceolate-ovate, 3-7.5 cm long, 1.5-3 cm broad, apically acuminate, basally acute, margins entire to undulate, glabrous above and below, cystoliths prominent and abundant on

both surfaces. **Inflorescences** of loose, terminal spikes or spicate panicles to 10 cm long, peduncle and rachis glabrous; bracts and bracteoles subulate, to 2 mm long, 1 mm broad, puberulous. **Flowers** sessile or with pedicels to 2 mm long; **calyx** segments linear-subulate, 1.5–2.5 mm long, 0.5 mm broad, glandular-puberulous; **corolla** color not observed, salverform, tube ca. 6.5 mm long, 0.5 mm broad at base expanded to 1.25 mm broad above midpoint, puberulous, lobes 5, subequal, oblong, apically obtuse, ca. 4.5 mm long, 2.5 mm broad, puberulous; **stamens** 4, included, anthers of anterior stamens 2-celled, apically and basally acute, ca. 1.5 mm long, 0.75 mm broad, filament 0.5 mm long, glabrous, posterior stamens sterile, 0.75 mm long. **Fruits** clavate, ca. 14 mm long, 3 mm broad, 1 mm thick, apically apiculate, puberulous to subglabrous; seeds 4, suborbicular, flattened, ca. 2 mm in diameter, including a wing ca. 0.5 mm broad surrounding the seed, glabrous.

Found in Costa Rica in tropical moist forests at lower elevations of the Caribbean watershed, with collections ranging from the Panamanian border to Livingston on the Río Reventazón. Flowering collections have been made from March and July.

*Chamaeranthemum tonduzii* can be recognized by its salverform corollas, four short, included stamens, with the posterior pair being sterile. It closely

resembles *C. durandii* and can be distinguished from it by its glabrous leaves, stems, and rachises.

### Dicliptera Juss.

**Herbs or shrubs, stems** more or less hexagonal in cross section. **Leaves** petiolate; laminae mostly ovate with entire or undulate margins. **Inflorescences** of cymes, spikes, panicles, or thyrses with flowers or flower clusters subtended by 2–4 pairs of conspicuous involucrate bracts. **Flowers** sessile or pedicellate, often showy; **calyx** 5-merous, hyaline; **corollas** narrow, slightly funnelform, bilabiate; **stamens** 2, anthers 2-celled, cells often unequal; **staminodes** absent. **Fruits** of ovate, elliptic, or clavate capsules; seeds 2 or 4.

A total of 150 species of New and Old World Tropics have been described for this genus, which is most easily recognized by its hexagonal stems and reduced cymes with bracts. It has been confused with *Blechum* and *Tetramerium*, but can be distinguished from these by the above characteristics.

### Key to Species of *Dicliptera*

- 1a. Inflorescences of axillary cymes; corollas more than 2 cm long ..... 2a
- 1b. Inflorescences of spikelike racemes or thyrses or axillary heads with peduncles; corollas less than 2 cm long ..... 5a
  - 2a. Inflorescences with peduncles less than 2 cm long; capsules up to 8 mm long ..... *D. pallida*
  - 2b. Inflorescences with peduncles more than 2 cm long; capsules more than 10 mm long ..... 3a
    - 3a. Floral bracts lanceolate and glandular-puberulous; flowers subsessile, pedicels ca. 1 mm long ..... *D. skutchii*
    - 3b. Floral bracts oblong, sparingly puberulous, or glabrous; flowers pedicellate, pedicels more than 2 mm long ..... 4a
      - 4a. Floral bracts apically rounded and apiculate; capsules puberulous; corolla puberulous ..... *D. trifurca*
      - 4b. Floral bracts apically acute to obtusish; capsules glandular-puberulous; corollas glandular-puberulous ..... *D. iopus*
  - 5a. Corollas white with lavender stripes; floral bracts to 7 mm long ..... *D. imbricata*
  - 5b. Corollas pinkish or lavender; floral bracts 9–14 mm long ..... 6a
    - 6a. Floral bracts spatulate, awned; inflorescence of spikelike racemes and/or axillary umbels ..... *D. unguiculata*
    - 6b. Floral bracts obovate or elliptic, not awned; inflorescence of peduncled axillary heads ..... *D. podocephala*

**Dicliptera imbricata** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1210. 1938. Figure 4.

**Herb** to 1 m tall; **stems** branched, sometimes rooting at lower nodes, **internodes** between leaf-bearing nodes

3–6 cm long, 1.5–2.5 mm thick, puberulous mostly at the angles in younger portions, basal portions terete and glabrous. **Leaves** with petioles to 4 cm long, puberulous; laminae ovate-elliptic, 3–10 cm long, 1–4 cm broad, apically acuminate, basally attenuate, margins entire,

glabrous, cystoliths dense and prominent on both surfaces. **Inflorescences** of terminal and axillary spikelike thyrses, to 4 cm long, 1.6 cm broad excluding corollas, 2 fanlike cymes of 3–5 flowers each at every node, each cyme subtended by a pair of oblong-lanceolate bracts 3–8 mm long, 0.5–1 mm wide, puberulous; **bracts** subtending the flowers unequal, obovate, to 7 mm long, 3.5 mm broad, whitish basally, greenish apically, strongly 3-nerved, puberulous with ciliate margins; outer pair of bracteoles linear, slightly falcate, 5 mm long, 0.75 mm broad, apically acuminate, ciliate, inner bracteoles lanceolate, 4 mm long, 0.5 mm broad, ciliolate. **Flowers** to 16 mm long; **calyx** segments linear-subulate, 3 mm long, 0.25 mm broad, minutely puberulous; **corolla** white, lavender-striped, puberulous, the tube cylindrical, 10 mm long, 1 mm broad, the lips oblong, 6 mm long, 2 mm broad, apically minutely dentate; **stamens** exserted to near the tips of the lips, filaments to ca. 5 mm long, puberulous; anther cells superposed, basally obtuse. **Fruits** elliptic, ca. 4 mm long, 1 mm broad, puberulous toward tip; seeds 2, oval, flattened, ca. 1 mm long, roughened.

Found in clearings and along trails in deciduous forest of Pacific watershed in Alajuela and Guanacaste provinces at elevations of 600 to 2000 m. Flowering collections have been made from late December through March.

*Dicliptera imbricata* is recognized by its dense, spikelike thyrses, its small (7 mm long), obovate bracts subtending each flower, and its small (16 mm long), white corollas. It is most easily confused with *D. unguiculata*, which has spine-tipped bracts and rose-purple corollas.

**Dicliptera iopus** Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica 9: 189. 1898, and in Pitt., Prim. fl. costaric. 2: 305. 1900. Figure 4.

**Shrub** to 3 m tall; **internodes** between leaf-bearing nodes 2–6 (9) cm long, 1.0–2.5 mm thick, strigose to glabrous. **Leaves** with petioles to 7 cm long, glabrous to sparingly puberulous; laminae ovate to elliptic, 3–15 cm long, 1–5.6 cm broad, apically acuminate, basally acute, margins entire, glabrous to sparingly strigose on both surfaces, cystoliths visible on both surfaces. **Inflorescences** in axillary cymes, each cyme subtended by 2 elliptic to ovate-oblong bracts, to ca. 3 cm long, 1 cm broad, apically acute, basally acute, glabrous to sparingly pilosulous; 2 **bracts** of unequal length subtending each flower, both linear-oblong, fused at base, the longer one 10–16 mm long, 4 mm broad at base, the shorter bract to 12 mm long, 4 mm wide, both apically acute, keeled, sparingly puberulous on both surfaces; 4 bracteoles, ob lanceolate, to 8 mm long, 2 mm broad, puberulous toward tip, inner pair smaller, 3.5 mm long, 0.5 mm broad; peduncles to ca. 6.5 cm long, subhexangular, puberulous along ridges, pedicels of middle pair in a cyme longest, to ca. 4 mm long, sparingly puberulous. **Flowers** usually 3 per cyme, although some have 2 or 4, 4–5 cm long; **calyx** 5-merous, coalesced for ca. 1/2 of its length, to 7

mm long, lobes linear, ca. 3.5 mm long, subtomentose; **corolla** lavender, inflated at about the middle of the tube, bilabiate, tube to 4 cm long, 2.5 mm broad at the base, 8 mm broad at the mouth, glandular-puberulous both inside and out, upper lip entire, acute, ca. 9 mm long, 5 mm broad, lower lip ca. 11 mm long, 8 mm broad at base, with 3 small, suborbicular lobes at its apex, ca. 0.5 mm long; **stamens** exserted, filaments flattened, pilose, anther cells equal; style exserted, glabrous. **Fruits** clavate, ca. 15 mm long, apically apiculate, densely glandular-puberulous, 2 seeds per capsule, flattened, suborbicular, ca. 3 mm in diameter.

Found rather commonly over a wide range in Costa Rica in open meadows and cloud forests at elevations of 1300 to 3200 m on both the Caribbean and Pacific slopes; also common in Panama and probably Nicaragua. Flowering collections have been made from September through March.

*Dicliptera iopus* is recognized by its peduncled cymes usually in clusters of three, acute to obtusish floral bracts, subtomentose pedicels, and glandular-puberulous corolla and capsule. It is easily confused with *D. trifurca*, which differs in its rounded and apiculate floral bracts, glabrous pedicels, and puberulous corollas and capsules.

**Dicliptera pallida** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1211. 1938. Figure 5.

**Herb** to 1.2 m tall; **stems** erect, branched, **internodes** between leaf-bearing nodes 4–10 cm long, 1.5–3.5 mm thick, subtomentose. **Leaves** with petioles to 1.6 cm long, subtomentose to glabrescent; laminae ovate, 3.5–8 cm long, 2–3.5 cm broad, apically acuminate, basally acute and slightly tapering, margins undulate, sparingly pilose above and below, cystoliths visible, but not prominent. **Inflorescences** in sessile or subsessile, axillary cymes, peduncles to 7 mm long, subtomentose; flowers of the upper cymes mostly sessile, those of the lower, short-pedicelled, the pedicel of the middle flower longer than that of the lateral flowers, all pedicels tomentose; **bracts** subtending the cymes, leaflike, 2–3 cm long, 1–1.5 cm broad, those subtending the flowers unequal, elliptic to oblanceolate, the larger of the pair ca. 16 mm long, 5 mm broad, the shorter ca. 13 mm long, 2.5 mm broad, both bracts apically acuminate, whitish toward the base, hirtellous; bracteoles unequal, both narrowly lanceolate, the longer to ca. 12 mm long, 1.25 mm broad, the shorter slightly smaller, both ciliolate. **Flowers** 2.5–3.5 cm long; **calyx** to ca. 5 mm long, fused ca. 1/3 of length, segments lanceolate, ca. 3 mm long, 0.75 mm broad, minutely ciliolate; **corollas** red, puberulous, the tube ca. 2 cm long, 2 mm broad at the base, narrowing to 0.5 mm broad just above the ovary, expanding to 3 mm broad at the mouth, the lips ca. 8 mm long, the upper emarginate, the lower minutely 3-lobed; **stamens** exserted nearly to the tip of the upper lip. **Fruits** clavate, to 8 mm long, 5 mm broad, 1 mm thick, puberulous; seeds discoid, ca. 3 mm in diameter, puberulous.

Found at middle to higher elevations in thickets and along streams on the slopes of the Cordilleras Central and Talamanca from 635 to 1700 m altitude. This species is apparently endemic to Costa Rica. Flowering collections have been made from December through February.

*Dicliptera pallida* is recognized by its axillary cymes with sessile to subsessile flowers, floral bracts and bracteoles with whitish bases, and comparatively long (more than 2 cm) red corollas. It can be distinguished from the much more common and weedy *D. unguiculata*, which it most closely resembles, by these characteristics.

**Dicliptera podocephala** Donnell Smith, Bot. Gaz. (Crawfordsville) 48: 299. 1909. Figure 5.

**Herb to subshrub**, to 1.5 m tall; stems erect, branching, internodes between leaf-bearing nodes 2–4 cm long, 1–2 mm thick, glabrous. Leaves with petioles to 2.5 cm long, puberulous; laminae ovate, 2.5–10 cm long, 1–4 cm broad, apically acuminate, basally acute, slightly tapering, margins entire, cystoliths dense and prominent on both surfaces, glabrous. Inflorescences in peduncled axillary heads, 1–several per axil, peduncles to 9.5 cm long, minutely puberulous mostly along 2 lines; bracts subtending the heads subulate, 3.5–5 mm long, 1 mm broad, glabrous; fertile flowers usually 5–7 per head, bracts subtending the flowers obovate to elliptic, 1 of each pair slightly larger than the other, the middle pair the largest, 10–14 mm long, 8–9 mm broad, apically rounded or obtuse, apiculate, narrowed at the base, subglabrous, margins ciliolate; bracteoles 4, linear-lanceolate, 5–8 mm long, puberulous. Flowers 14 mm long; calyx segments resembling bracteoles, slightly shorter; corolla pinkish lavender, 14 mm long, puberulous; stamens exerted. Fruits ovoid, 6 mm long, 4 mm broad, 1 mm thick, puberulous; seeds discoid, 2.5 mm in diameter, puberulous.

Found in damp meadows, streamsides, and along trails in Cartago and Puntarenas provinces near 1000 m elevation and at 90 m elevation at La Selva in Heredia Province. Only two collections, Allen 5902 (F) and Opler 597 (F), have been observed other than the type collection. Flowering collections have been made in February and March.

*Dicliptera podocephala* is recognized by its peduncled axillary heads with five to seven flowers per head and its obovate to elliptic bracts with rounded, apiculate tips. With these characteristics it can be distinguished from *D. unguiculata*, which it most closely resembles.

**Dicliptera skutchii** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1213. 1938. Figure 5.

**Shrub** to 3 m tall; erect, branching, internodes between leaf-bearing nodes 5–7 cm long, 3–5 mm thick, puberulous along 6 lines. Leaves with petioles 1–6.5 cm long, sparingly puberulous; laminae ovate-elliptic, 9–17 cm long, 3.5–7 cm broad, apically acuminate, basally acute, slightly tapering, margins entire, cystoliths relatively obscure above, more visible below, glabrous above and below. Inflorescences in axillary cymes on peduncles to 8 cm long, peduncles with appressed puberulence; pedicels short, 1–2 mm long, hirtellous; bracts subtending the cymes leaflike, to ca. 8 mm long; bracts subtending the flowers lanceolate, glandular-puberulous, unequal, the longer 10 mm long, 3 mm broad, the shorter 7 mm long, 2.8 mm broad; 2 pairs of bracteoles subtending each flower, the outer pair lanceolate, 6.5 mm long, 1.5 mm broad, glandular-puberulous toward apex, the inner pair lanceolate-elliptic, 3.5 mm long, 1 mm broad, glabrous. Flowers 3 per cyme, to 6 cm long; calyx to ca. 7 mm long, coalesced for ca. ½ its length, the lobes subulate, 3.5 mm long, 1 mm broad at the base, margins glandular-ciliolate; corolla purple, glandular-puberulous, the tube ca. 5 cm long, 3 mm broad at base, expanding to 10 mm broad above the middle and narrowing to 7 mm broad at the mouth, the lips to 10 mm long, 1 acute and finely notched at the tip, the other minutely 3-lobed, the lobes suborbicular, ca. 0.75 mm in diameter; stamens exserted to nearly the end of the lips. Fruits not seen.

Found in cloud forests at elevations around 1000 m in the vicinity of El General. Only one collection, Skutch 4140 (MO), in addition to the type specimen, Skutch 3090 (US), has been observed. Flower collection has been made in February.

*Dicliptera skutchii* can be recognized by its peduncled cymes with short pedicels and its glandular-puberulous bracts, bracteoles, and corollas. By these characteristics it can be distinguished from *D. iopus*, which it most closely resembles.

**Dicliptera trifurca** Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 172. 1855. *Dicliptera trifurcata* (Oerst.) Hemsl., Biol. Centralbl. 2: 525. 1881. *Diapedium trifurcatum* (Oerst.) Kuntze, Revis. gen. pl. 2: 485. 1891. Figure 5.

**Herbs to subshrubs**, to 2 m tall; stems branching, internodes between leaf-bearing nodes 1.5–8 cm long, 1–3 mm thick, glabrous. Leaves with petioles to 5.3 cm long, glabrous to sparingly puberulous along 2 lines; laminae ovate-elliptic, 2.5–15 (18.5) cm long, 1–4 (5.6) cm broad, apically acuminate, basally attenuate, margins undulate, glabrous above, glabrous to sparingly puberulous along costa and veins below, cystoliths more prominent below. Inflorescences in axillary cymes of 3 flowers each; peduncles to 8 cm long, mostly glabrous; bracts subtending the cymes leaflike, frequently exceeding the calyx; floral bracts oblong to oblong-spatulate, of unequal lengths, the larger to 11 mm long, 2 mm broad, the smaller to 7 mm long, 1.5 mm broad, both apically

rounded and apiculate, glabrous; bracteoles oblong-lanceolate, to 5 mm long, 1 mm broad, sparingly puberulous. Flowers with pedicels to 3 mm long, glabrous to sparingly puberulous; calyx 6 mm long, segments subulate, 4 mm long, 0.6 mm broad, puberulous; corolla red-violet or purplish, puberulous, 3.5–5.5 mm long, the tube to 4 cm long, 2 mm broad basally, expanding to 7 mm broad at the mouth, the lips oblong, to ca. 1.5 cm long, the upper lip 7 mm broad, apically acute, lower lip 3-lobed, the lobes subequal, ca. 0.75 mm long; stamens exserted to the tip of the upper lip, filaments sparingly puberulous; anther cells parallel, ca. 3 mm long, basally apiculate. Fruits stipitate, to 18 mm long, 4 mm broad, 2 mm thick, puberulous; seeds 4, discoid, ca. 4 mm in diameter, papillose.

Found in higher elevation rain forests or cloud forests of the Cordilleras Central and Talamanca at elevations from 1300 to 2300 m. Flowering collections have been made from December through June; also found in adjacent Panama.

*Dicliptera trifurca* is recognized by its peduncled, three-flowered cymes with glabrous pedicels, rounded and apiculate floral bracts, puberulous corollas more than 3 cm long, and puberulous capsules. These features distinguish it from *D. iopus* which it closely resembles.

**Dicliptera unguiculata** Nees in Benth., Bot. voy. Sulphur 149. 1844. Figure 5.

Herbs to 1.5 m tall; stems erect or ascending, branched, internodes between leaf-bearing nodes 5.5–10 cm long, 1–2.5 mm thick, increasingly pilose toward tips, terete and glabrous below. Leaves soon deciduous, petioles to 9 cm long, pilosulous to subglabrous; laminae ovate to elliptic, 5–9 cm long, 3–5.5 cm broad, apically acuminate and often apiculate, basally acute to attenuate, margins entire to undulate, both surfaces of younger leaves pilose, older leaves subglabrous. Inflorescences composed of axillary umbels or in crowded terminal and axillary spike-like racemes to 9 cm long, 1.75 cm broad, bracts spatulate, unequal, the larger 10–12 mm long, 5.5 mm broad, the smaller 8–9 mm long, 3 mm broad, both apically awned, the awn ca. 2 mm long, both basally clawed, pilosulous, margins densely ciliate, 3-nerved; bracteoles linear-lanceolate, 3.5 mm long, 0.5 mm broad, ciliolate. Flowers sessile, to 15 mm long; calyx 2.5 mm long, coalesced a little more than  $\frac{1}{2}$  its length, lobes 1 mm long, minutely puberulous; corolla pink or lavender, puberulous, the tube 7 mm long, 1 mm broad at the base, 1.25 mm broad at the mouth, the lobes obovate, 8 mm long, 4 mm broad, 1 is apically obtuse, the other apically minutely 3-lobed. Fruits elliptic, 4 mm long, 2 mm broad, 0.75 mm thick, puberulous; seeds discoid, ca. 1.5 mm in diameter, puberulous.

This is the most common species of *Dicliptera* in Costa Rica. It is found in moist thickets, open

fields, and along roadsides at elevations of 900 to 1500 m. Flowering collections have been made between October and April. Its range extends north to Mexico, but it has not yet been collected in Panama.

*Dicliptera unguiculata* is recognized by its inflorescences of axillary umbels and spikelike racemes, with conspicuous obovate, awned bracts, short (to 15 mm long), pink or lavender corollas, and often leafless condition. By these characteristics it can be distinguished from *D. pallida*, a much less commonly occurring species, which it most closely resembles. It also resembles *D. imbricata*, which is much more common than *D. pallida*, but more easily distinguished by the above characteristics.

**Dyschoriste** Nees

REFERENCE—C. E. Kobuski, Ann. Missouri Bot. Gard. 15: 9. 1928.

Herbs to suffrutescent plants, stems prostrate, ascending or erect, glabrous or pubescent. Leaves sessile or petiolated; laminae mostly entire. Inflorescences cymose, capitate, or spicate, terminal or axillary. Flowers subtended by foliaceous bracts and bracteoles; calyx deeply 5-parted, usually subulate-setaceous, ciliate; corolla 5-lobed, obscurely or distinctly bilabiate, tube erect, limb spreading; stamens 4, didynamous, anthers 2-celled, cells oblong, minutely calcarate to mucronate at the base. Fruit a capsule which is included in the persistent calyx, oblong-linear, glabrous, 2–4 seeded, separating with difficulty at maturity into 2 valves; seeds flattened, suborbicular, with mucilaginous hairs when wet.

*Dyschoriste* is a widely distributed genus of about 100 species in both tropical and subtropical regions of the world. A few species are found in warm, temperate areas. Several species occur in Central America.

**Dyschoriste valeriana** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1215. 1938. Figure 5.

Herbs, prostrate, erect or ascending, to 60 cm tall, frequently rooting at nodes of lower stem, stems quadrangular; internodes between leaf-bearing nodes 1.5–4.5 cm long, 0.75–1.5 mm thick, puberulous to glabrous. Leaves petiolate to sessile, petioles to 1 cm long, glabrous to puberulous along 2 lines; laminae ovate, 2.5–5 (6) cm long, 1–2 (3) cm broad, apically acute to rounded or obtuse, basally attenuate, margins entire to undulate, cystoliths numerous, prominent above, obscure below,

glabrous to subglabrous on both surfaces. Inflorescences of sessile axillary cymes, cymes of 2–5 flowers; 2 bracts subtending each cyme, bracts oblanceolate, 10–18 mm long, 2.5–6 mm broad, glabrous, margins minutely ciliolate; floral bracts linear to linear-elliptic, to 10 mm long, 1 mm broad, bracteoles similar, but slightly smaller, margins of both minutely ciliolate. Flowers sessile, to 8–9 mm long; calyx 6–8 mm long at anthesis, 8–11 mm long at fructescence, coalesced for  $\frac{1}{3}$ – $\frac{1}{2}$  of its length by thin, easily torn tissue, lobes subulate, ca. 5.5 mm long, 1 mm broad at base, single-nerved, sparingly pilose along rib, margins ciliolate; corolla blue or purplish, puberulous, the tube 6 mm long, 2 mm broad at base, 2.5 mm broad at the mouth, subbilabiate, lobes oblong, apically rounded, upper lip with 3 lobes to 3 mm long, 2 mm broad, lower lip with 2 lobes to 2 mm long, 1.5 mm broad; stamens included, longer filaments to 2 mm long, shorter filaments to 1 mm long, all glabrous, anthers 1 mm long, minutely calcarate at the base of each cell, both cells joining to form an apiculate tip; ovary glabrous. Fruit oblong-lanceolate, 9 mm long, 2 mm broad, 1.75 mm thick, glabrous; seeds 4, ovate, flattened, 2.5 mm long, 2 mm broad, densely puberulous when wet.

Found in disturbed habitats along trails and roadsides in deciduous forest areas of Guanacaste from near sea level to about 650 m elevation. Flowering collections made from December to April. One collection has been made from a similar habitat in Panama. Since many collections of this species have been made near Nicaragua, I expect that *D. valeriana* occurs there also.

*Dyschoriste valeriana* is recognized by its square stem, small blue or purplish flowers, four stamens with two-celled anthers that have minutely calcarate bases, and two- to four-seeded capsules. It closely resembles *Hygrophila costata*, which lacks calcarate anthers and has 12 to 16 seeds per capsule.

### Elytraria Michx.

Herbs either caulescent or acaulescent. Leaves alternate or subopposite, basal or restricted to the terminal portion of the stem in a dense pattern, cystoliths lacking. Inflorescences compact, peduncles with imbricate, coriaceous bracts. Flowers sessile with persistent perianth except the soon deciduous corolla; bracts single; bracteoles 2; calyx 4-merous, segments narrow, entire or toothed apically; corollas 5-merous, bilabiate, white or blue, tube narrow, upper lip 1-lobed, lower lip 3-lobed; stamens 2, barely exerted, anthers 2-celled which are equal and parallel; ovary 2-celled; to 10 ovules in each cavity, style 1. Fruits a capsule, basally constricted and apically acute; seeds borne on papilliform funicles.

About 17 species have been described for this genus from southern North America plus New and Old World Tropics.

### Elytraria imbricata (Vahl) Pers., Syn. pl. 1: 23.

1805. *Justicia imbricata* Vahl, Eclogae americanae 1: 1. 1796. *Tubiflora squamosa* (Jacq.) Ktze., Revis. gen. pl. 2: 500. 1891. is no longer a valid synonym. The genus *Tubiflora* was rejected by the International Code of Botanical Nomenclature 1972. Figure 5.

A weedy caulescent herb, occasionally acaulescent, to 50 cm tall; internodes between leaf-bearing nodes 0–15 mm long, 2–3 mm thick, glabrous to sparingly puberulous or pilose. Leaves alternate, sessile to petiolate, petioles to 2 cm long, pilose; laminae ovate-lanceolate, 3.5–13 cm long, 2–4.5 cm broad, apically acute, basally attenuate, narrowing to a winged petiole, margins undulate, sparingly pilose above and below, more dense on costa and lateral veins. Numerous scapes borne at leaf axils, 5–28 cm long, branched or simple, covered with lightly appressed, sheathing, ovate, or subulate bracts. Inflorescences in terminal spikes, 1–several, 1.5–4 cm long, 4 mm broad; bracts oblong to elliptic, 4–6 mm long, 1.5–2 mm broad, awn-tipped and stiff with upper bracts bearing 4 hyaline wings, 2 rounded extending from base and 2 apical extending parallel to the apex; 2 bracteoles per flower, subulate, to 3 mm long, costa ciliate. Flowers sessile, 5–8.5 mm long; calyx segments to 4.5 mm long, posterior segment elliptic, bidentate, 1.25 mm broad, lateral segments subulate, 0.75 mm broad, anterior segment elliptic, bidentate, 0.75 mm broad, all segments transparent, puberulous; corolla pale lavender or blue, glabrous, tube cylindrical, 4–7 mm long, 0.5 mm broad, lower lip spreading, to 4 mm long, 3-lobed, the middle lobe 2 mm broad, 2-lobed at apex, the lobes rounded, ca. 1 mm long, the lateral lobes similar, but slightly smaller, the upper lip erect, to ca. 2 mm long, 1 mm broad, apically 2-lobed. Fruits elliptic, ca. 3 mm long, 1 mm broad, glabrous; mature seeds light brown, rounded, triangular, ca. 0.5 mm long, glabrous.

Found in dry pastures and along roadsides and trails of the Pacific watershed area at elevations of 50 to 1170 m. Flowering collections have been made from November through March. This species ranges from the southwestern United States to western South America. Leonard (1951) reports that in Central America this plant is used as a remedy for dysentery, and the crushed leaves are said to cure pimples.

*Elytraria imbricata* is recognized by its numerous spikes borne on axillary, bracted culms, its small bluish bilabiate corollas with awned, winged bracts, and its capsules lacking hooklike funicles. Superficially, this plant can be confused with *Aphe-landra tonduzii*, which differs in all of the above characteristics.

### Graptophyllum Nees

Shrubs with branching, ascending stems. Leaves sessile to petiolate, laminae often colored and variegated,

margins entire or dentate. Flowers pedicellate, in short, nearly sessile cymes, terminal panicles or solitary in the axils of the leaves; calyx 5-merous; corollas red or purple, bilabiate, the tube inflated above, with 2, short, recurved lobes, the lower lip 3-lobed; stamens 2; staminodes 2. Fruits of stalked, clavate capsules; seeds 2-4.

Ten species have been described for this genus, occurring in West Africa, New Guinea, Australia, and Polynesia. None is native to the New World.

**Graptophyllum pictum** (L.) Griff., Not. pl. asiat., part 4: 139. 1854. Based on *Justicia picta* L., Sp. pl. 1: 21. 1763. *G. hortense* (L.) Nees in Wall., Pl. asiat. rar. 3: 102. 1832. Figure 6.

Shrubs, stems to 3 m tall; internodes between leaf-bearing nodes 4-7 cm long, 3-4 mm thick, glabrous. Leaves sessile to short-petiolate, petioles to 4 mm long, glabrous; laminae ovate to elliptic, 4.5-11 (20) cm long, 2-7 (9) cm broad, apically acuminate, basally acute to obtuse, slightly tapering, purplish or green, variously marked with yellow, margins entire, cystoliths dense and generally prominent above, obscure below, glabrous on both surfaces. Inflorescences in terminal racemes, the rachis glabrous or sparingly puberulous. Flowers with glabrous pedicels to 8 mm long, each subtended by 1 subulate bract, bract 3 mm long, 2 mm broad at base, minutely ciliolate, bracteoles 2, similar to bracts although slightly smaller; calyx segments subulate, ca. 3 mm long, 1.25 mm broad at base, glabrous; corollas dark purple or crimson, glabrous outside, glandular-puberulous inside, 4.5-8 cm long, tube funneliform, ca. 3 cm long, 4 mm broad basally, 11 mm broad at the mouth, upper lip erect, oblong, ca. 16 mm long, 11 mm broad, apically 2-lobed, lobes rounded, 5 mm long, 4 mm broad, lower lip 3-lobed, lobes oblong, 15 mm long, narrowing to a rounded tip, middle lobe 7 mm broad, lateral lobes 6 mm broad; stamens exserted to just below the tip of the upper lip, filaments glabrous, anthers 4 mm long, 1 mm broad, cells slightly unequal at the base, acute apically and basally, staminodes to 3 mm long. Fruits not observed.

This is a species that is cultivated as an ornamental in the gardens of tropical America. According to Bailey (1949) it is probably native to New Guinea.

*Graptophyllum pictum* is recognized by its mottled leaves, relatively large (to 8 cm long), bilabiate corollas, two stamens with two-celled anthers and two staminodes. It resembles various species of *Odontonema*, but can be most easily distinguished from them by its mottled leaves and larger corollas.

### Habracanthus Nees

**Herbs or shrubs.** Leaves usually with ovate to elliptic laminae. Flowers borne in loose to dense panicles; calyx 5-merous, segments narrowly lanceolate; corolla blue, red, or yellow, salverform, bilabiate, upper lip narrow, cuneate, lower lip usually oblong-cuneate, apically 3-lobed, lobes rounded; stamens 2, exserted, divergent, anthers 1-celled, filaments attached below middle of anther; style exserted. Fruit a clavate capsule; seeds 4.

This is a genus of about 40 species found in Mexico, Central America, and northern South America.

**Habracanthus silvaticus** Nees in DC., Prodr. 11: 312. 1847. Figure 6.

Shrub to 2 m tall, younger stems quadrangular; internodes between leaf-bearing nodes 3-8 cm long, 1-2 mm thick, glabrous to strigose along 2 lines. Leaves with petioles 5-35 (75) mm long, glabrous to sparingly puberulous; laminae elliptic to ovate-elliptic, 6-13 cm long, 2.5-5 cm broad, apically acuminate, basally acute, glabrous to sparingly puberulous along costa and lateral veins, margins undulate, cystoliths prominent on both surfaces. Inflorescences of loose, terminal thyrses to 10 cm long, 5 cm broad, lateral branches of thyrses dichotomously branched, branches of inflorescence minutely strigose; bracts subulate, to 6 mm long, 1 mm broad at base, glabrous. Flowers with pedicels ca. 2 mm long; calyx whitish to purplish, segments subulate, 3-4 mm long, 0.5 mm broad at base, glabrous; corolla blue, bilabiate, 12-18 mm long, glabrous, tube ca. 8 mm long, near cylindrical, ca. 1 mm broad, the lips ca. 10 mm long, the upper lip oblong, 2 mm broad, apically rounded, lower lip elliptic, ca. 4 mm broad, apically 3-lobed, the lobes 0.5 mm long, middle lobe 1 mm broad, lateral lobes 0.5 mm broad; stamens exserted to ca. the tip of the upper lip. Fruit clavate, to 1.5 mm long, 3 mm broad, 2 mm thick, glabrous; seeds flattened, ovate, 2 mm long, 1.5 mm broad, puberulous.

A relatively common plant in wet forests and adjacent clearings of higher elevations on Pacific and Caribbean slopes of the Cordillera Central from 975 to 2200 m elevation. Flowering collections have been made from July through March. This species was first described in Chiapas, Mexico, and extends from there to Panama.

*Habracanthus silvaticus* is recognized by its bluish calyx and bilabiate corolla, with two stamens that have one-celled anthers; also by its inflorescence in a loose, terminal thyrsus. It resembles *Razisea spicata*, but can be distinguished from it in flower color and inflorescence.

## Hansteinia Oersted

**Herbs or shrubs.** Leaves opposite, usually petiolate; laminae elliptic or ovate. Inflorescences in loose or compact panicles which are sometimes thyrsoid; flowers with 5-merous calyx, calyx segments narrow, equal; corollas red, orange, yellow, or white, cylindrical, narrow basally, abruptly expanded just above the calyx, somewhat obliquely enlarged and oblong, often constricted again at the mouth; upper lip erect, the lower lip barely distinct from the corolla tube, 3-lobed; stamens 2, attached at base of corolla tube, exserted, anthers 1-celled, basally obtuse. Fruits a capsule, clavate, glabrous, 4-seeded.

### Key to Species of *Hansteinia*

- 1a. Leaf bases rounded or subcordate ..... 2a  
1b. Leaf bases attenuate (except leaves subtending the inflorescence) ..... 3a  
2a. Corolla more than 20 mm long, glandular-puberulous; petioles mostly more than 2 cm long ..... *H. ventricosa*  
2b. Corolla less than 20 mm long, glabrous; petioles less than 5 mm long ..... *H. sessilifolia*  
3a. Capsules less than 12 mm long; leafy internodes 7–8.5 cm long ..... *H. gracilis*  
3b. Capsules more than 12 mm long; leafy internodes 6 cm or less long ..... 4a  
4a. Inflorescences in fairly open racemose panicles, branches relatively few, erect or ascending; bracts 2–5 mm long ..... *H. stricta*  
4b. Inflorescences in compact cymose panicles, branches numerous, spreading; bracts 5–10 mm long ..... *H. blepharorhachis*

**Hansteinia blepharorhachis** (Lindau) Durkee, comb. nov. *Kolobochilus blepharorhachis* Lindau, Anales Inst. Fis.-Geogr. Nac. Costa Rica 9: 189. 1898, and in Pitt., Prim. fl. costaric. 2: 309. 1900. *Glockeria blepharorhachis* (Lindau) Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1218. 1938. *Razisea breviflora* D. Gibson, Fieldiana, Bot. 34: 77. 1972. Figure 6.

**Herbs to suffrutescent plants to 2 m tall, stems** subquadangular to quadrangular in younger portions; **internodes between leaf-bearing nodes 1.5–8 cm long, 1.5–2.5 mm thick,** sparingly pilose mostly along 2 lines. Leaves with petioles 2–6 cm long, sparingly pilose; laminae elliptic-ovate, 7–18 cm long, 2–6.5 cm broad, apically acuminate, basally attenuate, margins undulate to crenulate, older leaves mostly glabrous, drying to very dark green or nearly black above, younger leaves with pilose hairs restricted to costa and veins, cystoliths abundant though minute and obscure, more visible beneath. Inflorescences in long, narrow, terminal thyrsoid panicles to 30 cm long, 3–5 cm broad; peduncle to 7 cm long, puberulous, the rachis pilose to subtomentose with brown to reddish brown hairs plus longer, scattered, glandular hairs, pedicels to 8 mm long, pubescence that of the rachis; **bracts** narrowly subulate, 5–10 mm long, 1.5–3 mm broad, bracteoles similar, but smaller, both puberulous plus a few longer glandular hairs. Flowers with 5-merous calyx, segments linear, 4.5–10 mm long, 0.75–

Fourteen species have been described for this genus, ranging from Mexico to Bolivia. In Costa Rica the species are all found at elevations above 1000 m. Generally these species are not often collected in Costa Rica, which may indicate infrequent occurrence. This genus closely resembles the genera *Habracanthus* and *Razisea*. See the genus description of *Razisea* for a discussion of these differences.

1 mm broad, minutely puberulous, plus much longer glandular hairs; corolla orange or orange-red, 15–22 mm long, the tube to ca. 14 mm long, 4 mm broad at base, expanding abruptly to 5–6 mm broad just above the calyx, glabrous outside, pilosulous glandular hairs inside, upper lip erect, oblong, 4–8 mm long, 3–4 mm broad, apically rounded, lower lip short, truncate, 3-lobed, lobes each ca. 1 mm long, suborbicular; stamens exserted to well above the upper lip. Fruits clavate, 13–15 mm long, 3.5–4 mm broad, 2.5–3 mm thick, glabrous; seeds flattened, ovate, 2.5–3.5 mm long, 2–2.5 mm broad, surface muricate.

Plants of cloud forests at elevations of 1500 to 2000 m. The locality of the type specimen (*Warscewicz s.n.*) is specified only as Costa Rica and Veraguas (Panama). Flowering collections have been made in April, August, and October from the Cordilleras Tilarán, Central, and Talamanca. This species occurs rather frequently in light gaps. It occurs in habitats similar to those of *Razisea spicata* and is also hummingbird-pollinated.

*Hansteinia blepharorhachis* is recognized by its compact and comparatively narrow, but much-branched, cymose panicles (thyrses) combined with leaf blades which are elliptic-ovate with attenuate bases. It is most similar to *H. stricta*, which differs

in its generally smaller, less compact, less branched, broader racemose panicles and smaller bracts (2.5 mm long vs. 5 to 10 mm).

**Hansteinia gracilis** Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 143. 1855.

Herb to suffrutescent plant to ca. 60 cm tall; stems subtetragonal, erect, simple or sparingly branched, internodes between leaf-bearing nodes 7–8.5 cm long, puberulous. Leaves with petioles to ca. 2.5 cm long; laminae elliptic-ovate, to 18 cm long, 7 cm broad, apically acuminate, basally attenuate, margins subpand-crenate, glabrous on both surfaces except minutely strigose on costa and veins. Inflorescences in terminal panicles to 15 cm long, rachis glandular-pubescent, hairs rust-colored. Flowers with 5-merous calyx, calyx segments red, 7–9 mm long at anthesis, 13.5–16 mm long at fruiting stage, glandular-villous; corolla red, 13.5–16 mm long, tomentose. Fruit 9–11 mm long, puberulous.

Found in dense, damp woods on Mt. Jaris northeast of Santiago (Santiago de Puriscal) in San José Province, elevation 500 to 1000 m. I have seen no collections of this species. The above description was adapted from the original, which was based on a collection in both flower and fruit collected in November.

*Hansteinia gracilis* differs from other Costa Rican species in the genus by its shorter capsules (9 to 11 mm long vs. 12 mm or more) and its longer internode lengths (7 to 8.5 cm long vs. 6 cm or less).

**Hansteinia sessilifolia** (Oerst.) Durkee, comb. nov.  
*Glockeria sessilifolia* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 141. 1855. Figure 6.

Herbs to suffrutescent plants to 2 m tall, older stems terete, younger stems subquadangular, glabrous to puberulous along 2 lines; internodes between leaf-bearing nodes 4.5–5.5 cm long, 1.5–2.5 mm thick. Leaves sessile (in those subtending the inflorescence) to petiolate, petioles to 4.5 cm long, puberulous; laminae ovate, 5.5–11 cm long, 2–6 cm broad, apically acuminate, basally rounded or subcordate in leaves at base of inflorescence to acute in lower leaves, margins entire to undulate, glabrous or sparingly pilose on both surfaces, hairs mostly restricted to costa and veins, cystoliths abundant on both surfaces though minute and obscure. Inflorescences in loose, terminal, dichotomously branching, thyrsoid panicles to 38 cm long, 15 cm broad, sometimes with additional axillary panicles, rachises and branches puberulous to sparingly so, pedicels to 2.5 mm long, sparingly puberulous; bracts narrowly triangular, to 3 mm long,

0.5 mm broad, glabrous to very sparingly puberulous. Flowers with 5-merous calyx, calyx segments linear-subulate, to 4–6 mm long, 0.3–0.5 mm broad, sparingly glandular-puberulous; corolla red and yellow, 12–22 mm long, glabrous, the narrow basal portion 2.5–3 mm long, 1–2 mm in diameter, the upper portion expanded to 3–5 mm diameter, then gradually narrowing to 2.5–4 mm diameter at the mouth, the upper lip spatulate, apically acute, 3.5 mm long, 1.5 mm broad at the base, 0.5 mm broad at the lip, lower lip short, recurved, ca. 1 mm long, 3 mm broad, lobes apically rounded; stamens exserted to 5 mm beyond upper lip, anthers 2–2.8 mm long; capsules clavate, 12–14 mm long, 2.3–3 mm broad, 1.8–2.5 mm thick, glabrous; seeds flattened, elliptic 2–2.2 mm long, 1.2–1.4 mm broad, hispidulous.

A plant of the wooded, southern slopes of Volcán Barva (Barba), Volcán Poás, and the Monteverde cloud forest area in Puntarenas Province. I have seen only two collections of this species, Leon 79 (F) and Dryer 1671 (F). Flowering collections have been made in September and October.

*Hansteinia sessilifolia* is recognized by its loose, dichotomously branching inflorescences and its short corollas (12 to 22 mm long) with stamens slightly exserted. It most closely resembles *H. ventricosa*, but can be distinguished from it by the above characteristics.

**Hansteinia stricta** (Leonard) D. Gibson, Fieldiana, Bot. 34: 63. 1972. *Glockeria stricta* Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1219. 1938. Figure 6.

Herb to subshrub to 1.5 m tall, older stems terete, glabrous, younger stems quadrangular, sparingly puberulous or scattered brown puberulence along 2 lines; internodes between leaf-bearing nodes 3–6 cm long, 1.5–2 mm thick. Leaves with petioles 1.5–3.3 cm long, glabrous to puberulous; laminae ovate, 6–12 cm long, 2.5–5 cm broad, apically acuminate, basally attenuate, margins entire to undulate, sparingly and minutely strigose on both surfaces, mostly restricted to costa and veins, minute cystoliths abundant and apparent on both surfaces. Inflorescences in terminal and axillary racemose panicles to 27 cm long, 8 cm broad; rachis and branches minutely puberulous plus much longer (to 1 mm), scattered glandular hairs, pedicels subsessile to 8 mm long, pubescence that of the rachis; bracts and bracteoles subulate, 2–5 mm long, 1–2 mm broad, minutely puberulous plus a few longer glandular hairs. Flowers with 5-merous calyx, calyx segments narrowly linear or subulate, 4.5–8 mm long, 0.75–1 mm broad, minutely puberulous plus scattered glandular hairs; corolla orange-red and yellow, 15–19 mm long, 1.5 mm broad at base expanding abruptly to 6 mm broad above the calyx and narrowing to 5 mm broad at the mouth, sparingly puberulous, upper lip erect, 4 mm long, 3 mm broad, apically acute, lower lip 3-lobed, lobes rounded, 0.75 mm long, 1 mm broad; stamens exserted well beyond the tip of the upper lip. Fruits

clavate, 13–15 mm long, 3.5 mm broad, 2.5 mm thick, glabrous; seeds ovate, flattened, 2.5 mm long, 2 mm broad, muricate.

Found in moist forests on the slopes of the Cordilleras Central and Talamanca at elevations of 1500 to 1900 m. Flowering collections have been made in November, December, and February.

*Hansteinia stricta* is recognized by its ovate leaves with attenuate bases and its open paniculate inflorescences with relatively few branches and these strict, erect, or ascending. It most closely resembles *H. blepharorhachis*, which has cymose panicles (thyrses), with narrower, more compact branching and larger bracts (5 to 10 mm long vs. 2 to 5 mm).

**Hansteinia ventricosa** (Donnell Smith) D. Gibson, Fieldiana, Bot. 34: 63. 1972. *Glockeria ventricosa* Donnell Smith, Bot. Gaz. (Crawfordsville) 27: 439. 1899. Figure 6.

**Herbs to subshrubs** to 3 m tall, older stems terete, younger stems subquadrangular; **internodes** between leaf-bearing nodes 2–7 (11) cm long, 1.5–3 mm thick, sub-tomentose, hairs ca. 1 mm long. **Leaves** with petioles to 5.8 cm long, pilose to subtomentose; laminæ ovate to ovate-elliptic, 7–15 cm long, 3–12 cm broad, apically acuminate, basally subcordate to rounded or obtuse, margins crenulate to undulate, both surfaces pilose, cystoliths minute. **Inflorescences** in terminal and axillary thyrses to 29 cm long, 11 cm broad excluding corollas, rachises and branches pilose plus glandular hairs to puberulous, pedicels to 9 mm long, puberulous-glandular; **bracts** and bracteoles oblong to narrowly lanceolate, to 9 mm long, 2 mm broad, apically acute to acuminate, puberulous to pilose plus occasional glandular hairs. **Flowers** with 5-merous **calyx**, segments linear to 7 mm long at flowering and to 12 mm long at fruiting stage, 1 mm broad, puberulous plus occasional glandular hairs; **corolla** orange, 2.6–3 cm long, tube curved outward, sparingly glandular-pilose, 2 mm broad basally, contracting just above the ovary and then expanding abruptly to 5 mm broad just above the calyx lobes, the upper lip erect, elliptic, to 5 mm long, 2 mm broad, apically bidentate, lower lip ca. 1.5 mm long, 3-lobed, the lobes ca. 1 mm long, rounded; **stamens** exerted to ca. 1.5 cm beyond the tip of the upper lip. **Fruits** clavate, 11–19 mm long, 3–4 mm broad, 3–4 mm thick, glabrous; seeds 4, oblong, flattened, basally oblique, 2 mm long, 1.5 mm broad, coarsely roughened.

This is a comparatively wide-ranging species found in shade or partial shade of moist, evergreen forests of the Cordilleras Tilarán, Central, and Talamanca and of adjacent areas in Panama at elevations between 1000 and 2500 m. Flowering col-

lections have been made in October, December, January, and February.

There is variation in the degree of hairiness among specimens from over the range of *Hansteinia ventricosa*. Early flowering specimens in particular may be confused with *Razisea spicata*, but can be distinguished from it with their shorter corollas (2.6 to 3 cm vs. 4 to 6.2 cm long), which expand more abruptly, and by the more profuse branching of the inflorescences. *Hansteinia ventricosa* resembles *H. stricta* and *H. blepharorhachis* somewhat, but can be distinguished from them by its broader laminae, with rounded, subcordate, or obtuse bases, as opposed to their narrowed laminae with attenuate bases.

### Henrya Nees

REFERENCE—G. B. Happ, Monograph of *Tetramerium* and *Henrya*. Ann. Missouri Bot. Gard. 24: 501–582. 1937.

**Herbaceous to suffrutescent perennials;** stems erect, spreading or decumbent, younger stems often pubescent with glandular hairs, tetrangular to subterete, with pale, often exfoliating, epidermis. **Leaves** petiolate, often deciduous; laminæ rotund-ovate to linear, entire, pubescent to glabrous on both surfaces, cystoliths present. **Inflorescences** in terminal and axillary spikes with loosely or densely imbricated bracts; caudine **bracts** solitary; involucral bracts coalescent from base to near the apex on the posterior side and closely enclosing the fruit, green, mucronate at or near the apex. **Flowers** sessile or short-pedicellate; **calyx** 5-merous; **corolla** narrowly funnel-form, bilabiate, tube ca.  $\frac{1}{3}$  the length of the corolla, anterior lip 3-lobed, the posterior lip shallowly bilobed or entire; **stamens** 2, exserted; anthers 2-celled, nearly parallel, one cell longer than the other. **Fruit** a capsule, seeds 2, flattened, hispid to hispidulous on one side, glabrous on the other.

Happ had recognized 20 species for this genus, ranging from the northern states of Mexico and adjacent United States to Costa Rica. He considered the position of the mucro on the involucral bract to be a very important character in species designations. This has been questioned by some, and it appears that there are many fewer species than he designated.

**Henrya scorpioides** Nees in DC., Prodr. 11: 491. 1847. *Tetramerium scorpioides* (Nees) Hemsl., Biol. Centralbl. 2: 526. 1882.

**Herbs** to suffrutescent plants to 1 m tall; older stems terete, internodes between leaf-bearing nodes 2–4 cm long, 1–1.5 mm thick, puberulous. Leaves with petioles 1–15 mm long, puberulous; laminae ovate, 1–6 cm long, 0.5–3 cm broad, apically acute to acuminate, basally obtuse to acute, margins entire, puberulous-glandular on both surfaces, often glabrate with age, cystoliths prominent on both surfaces. Inflorescences 2–10 cm long, loosely imbricated caudine bracts linear-elliptic, elliptic or linear-ob lanceolate, 2–4 mm long, 1–2 mm broad; involucral bracts oblanceolate, 7–9 mm long, glandular-puberulous, the mucro just below the apex. Usually 2 flowers per bract, only 1 producing a fruit, calyx segments lanceolate, ca. 1.5 mm long; corolla pale yellow to cream-colored, 10–15 mm long. Fruits clavate, 4.5–6 mm long, 1.5–2.5 mm broad, ca. 1 mm thick, puberulous; seeds 1 or 2, flattened, elliptic, ca. 1.5 mm long, 1.25 mm broad, margins hispidulous.

This species ranges from Mexico to Costa Rica. Habitats have been described only as “rocky soil” or “rocky thorn forests.” Only one collection from Costa Rica, M. Quirós 671 (F), is known. It was collected in flower at Desamparados de San Mateo, Alajuela Province, in March at 100- to 500-m elevation.

*Henrya scorpioides* is recognized by its spicate inflorescences, with loosely imbricated bracts, its coalesced involucral bracts that are conspicuously glandular-puberulous and are 7 to 9 mm long, and its caudine bracts that are conspicuously shorter than the involucral bracts (2 to 4 mm long). This may be confused with *Tetramerium nervosum*, which differs in its more compact spikes with larger bracts that are four-ranked and lack the coalesced involucral bract.

### Herpetacanthus Nees

**Herbs** or shrubs. Inflorescences spicate; bracts loosely imbricate. Flowers with a 5-merous calyx, calyx segments equal; corolla 5-merous, bilabiate, upper lip apically bidentate, lower lip 3-lobed; stamens 4, didynamous, inserted or barely exserted, the longer of each pair 2-celled with one of the cells superposed, the shorter of each pair 1-celled. Capsules clavate; seeds 4.

This is a genus of about 10 species, ranging from Central America to Brazil. Most of the species described are from Brazil. This genus is distinguished from other genera in the family with bilabiate corollas by its didynamous stamens, the longer pair 2-celled, with one of the cells distinctly superposed and the shorter pair of stamens one-celled.

**Herpetacanthus panamensis** Leonard, J. Wash. Acad. Sci. 32: 185. 1942. *Standleyacanthus costaricanus* Leonard, Ceiba 3: 143. 1952. Figure 7.

**Herbs** or **subshrubs** to 1 m tall; stems ascending, sparingly branched, rooting at lower nodes in some, younger stems quadrangular, puberulous to pilose mostly along 2 lines, hairs with a purplish or reddish banding pattern, older stems terete, glabrous; internodes between leaf-bearing nodes 2.5–4 cm long, 0.75–1.25 mm thick. Leaves with short petioles to 1 cm long, pubescence that of the stem; laminae ovate to ovate-elliptic, 4–14.5 cm long, 2.5–6 cm broad, apically acute to acuminate, basally acute to attenuate, margins undulate, glabrous to strigose on the costa and veins of both surfaces, cystoliths dense and prominent on both surfaces. Inflorescences in lax terminal and axillary spikes or spicate panicles, spikes to 3.5 cm long, 2.5 cm broad; bracts loosely imbricate, ovate to elliptic, 9–14 mm long, 4–7 mm broad, apically acute to acuminate, glabrous or subglabrous, margins ciliate; bracteoles linear to narrowly elliptic, 6–8 mm long, 0.5–1 mm broad when fruits are mature, glabrous, margins sparingly ciliate. Flowers with 5-merous calyx, segments subulate, 3–4 mm long, 0.5 mm broad, minutely glandular-puberulous inside, glabrous outside, tipped by 1 or 2 hairs; corolla white, to 17 mm long, the tube 11 mm long, 2 mm broad at base, 3.5 mm broad at the mouth, glabrous, the lips ca. 5.5–8 mm long, puberulous toward the tip, upper lip ovate, 4 mm broad, apically minutely bidentate, lower lip 3-lobed, lobes 2–3 mm long, middle lobe rounded, 2.5 mm broad, lateral lobes acute, ca. 1.5 mm broad, the stamens exserted or included, filaments of the longer pair 3 mm long, of the shorter pair 2 mm long, glabrous, anthers ca. 1 mm long, 0.3 mm broad. Fruits clavate, 9–10 mm long, stipe 3.5–4 mm long, 0.5 mm thick, seed-bearing portion 3 mm broad, 1.5 mm thick, glabrous; seeds 4, flattened, ovate, 2.5 mm long, 2.0 mm broad, roughened.

Collected in wet, shaded areas of forests, frequently along streams from near sea level to ca. 800 m in Panama and Costa Rica. In Costa Rica most collections have been made in Alajuela, Heredia, and Limón provinces of the Caribbean watershed area, but one, Allen 6297 (F, CR) is known from Esquinas forest of Puntarenas Province. Flowering collections in Costa Rica have been made in March, July, September, and October. The September collection, Allen 6297 (F), was from an area which has a more extended dry season than the others. One collection, Opler 119 (F), describes the bracts as purplish. This specimen has, as have most others, dark purplish green bracts when dried; some, however, such as Schnell 810 (F), collected inland from Puerto Viejo in Limón Province, have yellowish green bracts. This variation may be regional, or it may be an age difference, since the Schnell collection was in an early flowering stage with no fruits.

*Herpetacanthus panamensis* may be confused with various of the larger-bracted species of *Jussiaea*, but can be easily distinguished from them, with its second pair of stamens that are single-celled (vs. two, two-celled stamens, with cells that are frequently superposed). If stamens are missing, the loosely imbricate bracts that are frequently purplish are the best distinction.

### Hygrophila R. Brown

Erect or diffuse herbs. Leaves opposite. Flowers in axillary fascicles; bracts linear; calyx 5-merous, segments subequal; corolla tubes subcylindric, small, the limb 2-lipped; stamens 4, didynamous, or 1 perfect stamen and a staminode in each pair, the filaments in each pair, united at the base; anthers 2-celled, some mucronulate; posterior stigma lobe abortive. Fruit an oblong, non-stipitate capsule; seeds 4–18 or more.

This genus is pantropical, with about 80 species. *Hygrophila* has some resemblance to the genus *Dyschoriste*, but can be distinguished from it in Central America by its white flowers (vs. blue or purple) and capsules with numerous seeds (14 to 48 vs. two to four).

**Hygrophila costata** Nees, Pl. hort. bonn. icon. 2: 7. t. 3, 1824, and in DC., Prodr. 11: 88. 1847.  
*H. guianensis* Nees, London J. Bot. 4: 634. 1845.  
*H. conferta* Nees in Mart., Fl. bras. 9: 21. 1847.  
Figure 7.

Herbs to 1.5 m tall, sometimes declining and rooting at lower nodes, stems obtusely quadrangular; internodes between leaf-bearing nodes 2–7 (10) cm long, 1–3 mm thick, glabrous. Leaves petiolate to subsessile, petioles to 2.5 cm long, glabrous; laminae lanceolate to elliptic, 3.5–18 cm long, 0.5–5 cm broad, apically acuminate, basally attenuate, margins entire to undulate, cystoliths very numerous on the upper epidermis, less numerous on the lower, glabrous above, sparingly puberulous below, mostly restricted to costa and veins. Flowers sessile, often in clusters of 3 or 4, bracts lanceolate-elliptic, 6–9 mm long, 1.5–3 mm broad, sparingly puberulous, bracteoles similar, 2–3 mm long, ca. 0.5 mm broad, calyx segments linear, equal, 5–9 mm long at anthesis, 6.5–12 mm long in fruit, sparingly puberulous; corolla white, sometimes streaked or spotted with purple, 5.5–9 mm long, tube ca. 1.5 mm broad at base, expanding to 2 mm broad at the throat, puberulous, 2-lipped, lips ca. 3 mm long, upper lip 2-lobed, lower lip 3-lobed; stamens 4, didynamous, filaments of each pair united at the base, anthers 2-celled, ca. 1 mm long, cells basally mucronulate; fruits narrowly oblong, sessile, glabrous, 8–13 mm long, 6–8 seeds per locule.

This is a wide-ranging plant found from Mexico to central Argentina in moist habitats. In Costa Rica it has been collected along streams, rivers, forested thickets, weedy roadsides, open pastures, and rain forests from sea level of the Osa Peninsula to mountain slopes of the Cordilleras Talamanca and Central at 1500 m.

*Hygrophila guianensis* and *H. costata* have been distinguished by leaf shape and size, length of calyx, corolla, and capsule. I have brought *H. guianensis* into synonymy because the numerous measurements of all these characters in Costa Rican collections intergrade and overlap. Furthermore, they show no habitat differences. This is a common and wide-ranging complex, which on the basis of these observations, appears to be one species.

*Hygrophila costata* is recognized by its sessile flowers often in clusters of three or four, its inconspicuous, white, bilabiate corollas with four didynamous stamens with two-celled, basally mucronulate anthers, and its oblong, sessile capsule with 12 to 16 seeds.

### Hypoestes Soland.

REFERENCE—W. T. Thiselton-Dyer, Flora of Central Africa 5: 244. 1900.

Herbs or shrubs. Leaves petiolate. Inflorescences in axillary and/or terminal spikes or panicles; floral leaves resembling reduced vegetative leaves often present; bracts 2 per flower, free or coalesced for  $\frac{1}{3}$ – $\frac{2}{3}$  of their length. Flowers with 5-merous calyx, calyx lobes equal, subulate, free or coalesced  $\frac{1}{3}$ – $\frac{2}{3}$  of their length; corolla bilabiate, tube narrow, gradually expanding to the mouth, upper lip 2-lobed, lower lip 3-lobed; stamens 2, anthers 1-celled, basally rounded. Fruits clavate; seeds 2 or 4.

This is a genus of the Paleotropics, with 150 species extending from Africa to Australia. Most species are found in Madagascar.

### Hypoestes phyllostachya Baker, J. Linn. Soc., Bot. 22: 511. 1887. Figure 7.

Herbs to 70 cm tall, young basal shoots especially velutinous; internodes between leaf-bearing nodes 2–6 cm long, 1.25–2.0 mm thick, subtriangular, glandular plus appressed hairs to appressed hairs at angles only. Leaves petiolate, petioles to 2.5 cm long, appressed hairs on upper surface only; laminae ovate, 2–4.5 cm long, 1.5–2.5 cm broad, apically acute, basally obtuse to

rounded, margins entire, glabrous to sparingly puberulous on the midrib of both surfaces, most surfaces dotted with numerous pink spots to ca. 4 mm in size, cystoliths present on both surfaces. **Flowers** borne singly and in terminal and axillary spikes, often with a gradual transition from solitary flowers to spikes, rachises glandular-puberulous; **bracts** 2 per flower, fused for up to half their length, oblong, 12–15 mm long, 1.4–1.5 mm broad, apically acute to obtuse, with one bract slightly longer than the other, velutinous plus glandular hairs, bracteoles subulate, apically tapered, 10–11 mm long, 1.2–1.3 mm broad, velutinous; flowers sessile. **Flowers** with a 5-merous calyx, 6–7 mm long, segments equal, subulate, fused for ca. half their length; **corolla** magenta, 24–25 mm long, ca. 3 mm broad at the mouth, 0.7 mm broad basally, puberulous, upper lip 11–12.5 mm long, 3-lobed, lobes rounded, ca. 1 mm long, ca. 3.5 mm broad, lower lip 9.5–11 mm long, ca. 1.5 mm broad; **stamens** exerted, anthers 1-celled, ca. 1.7 mm long, 0.6 mm broad. **Fruits** clavate, 10–11 mm long, 1.4–1.6 mm broad, 1.6–1.7 mm thick, puberulous toward apex; seeds 4, oval, 1.6–1.8 mm long, 1.1–1.2 mm broad, papillate.

This species is native to tropical Africa, but is often cultivated for its attractive foliage. Escapes from cultivation have been made along road banks in two cloud forest areas in Costa Rica, the Monteverde community at 1500 to 2000 m elevation in Puntarenas Province and near San Miguel at about 1600 m elevation in Heredia Province. Flowering collections were made in April and December.

*Hypoestes phyllostachya* is most easily recognized by its pink-dotted leaves and magenta corolla, with a three-lobed upper lip and one-lobed lower lip. It is not easily confused with other Central American species of Acanthaceae.

### Justicia Linnaeus

**Herbs, shrubs, or vines.** Leaves petiolate, laminae usually ovate to elliptic and entire, cystoliths present and usually prominent on both surfaces of dried specimens. **Inflorescences** usually of spikes or panicles, occasionally in cymes or solitary; bracts various, small and distant, linear or subulate to large, conspicuous and imbricate. **Flowers** with calyx segments usually narrow and equal, some unequal, mostly 5(4)-merous; **corollas** bilabiate, usually white, pink, or purple, the tube usually narrow, funneliform, the upper lip 2-lobed, the lower lip 3-lobed; **stamens** 2, usually slightly exserted, but not exceeding the upper lip, anther cells 2, usually unequal, often superposed, with 1 or both cells apiculate or calcarate, the connective narrow to broad. **Fruits** a capsule, clavate, 4-seeded.

This is the largest and most complex genus of the Acanthaceae, with approximately 420 species found mostly in the tropics, but extending well into temperate habitats. It is worldwide in distribution. The genus as treated here includes what, until recently, was recognized as *Beloperone* and *Jacobinia*.

The Costa Rican species of *Justicia* are wide ranging, from near sea level to just above 2000 m elevation. Most species are found between 500 and 2000 m in moist habitats around openings or along trails in forests. Three species are found in disturbed habitats. About five species are cultivated.

*Justicia* may be recognized by its two slightly exserted stamens with two-celled anthers that are frequently unequal, superposed, and basally apiculate and calcarate. In addition, the bilabiate, narrow-tubed corollas and the lack of staminodes are useful features.

### Key to Species of *Justicia*

- |  |                          |
|--|--------------------------|
| 1a. Inflorescences in spikes or cymes .....                                  | 2a                       |
| 1b. Inflorescences in panicles or thyrses (cymose panicles) .....            | 23a                      |
| 2a. Inflorescences in axillary cymes .....                                   | 3a                       |
| 2b. Inflorescences in spikes borne singly or in clusters .....               | 4a                       |
| 3a. Leaves of a pair unequal; corolla violet or pale purple .....            | <i>J. trichotoma</i>     |
| 3b. Leaves of a pair equal; corolla orange-red to yellowish .....            | <i>J. macrantha</i>      |
| 4a. Leaves apically obtuse to rounded .....                                  | <i>J. chamaephyton</i>   |
| 4b. Leaves apically acuminate or acute .....                                 | 5a                       |
| 5a. Bracts 4–19 mm long, imbricate .....                                     | 6a                       |
| 5b. Bracts 1–3.5 mm long, lax (not imbricate) .....                          | 20a                      |
| 6a. Bracts spatulate; calyx segments 8–11 mm long .....                      | 7a                       |
| 6b. Bracts otherwise; calyx segments 4–7 mm long .....                       | 8a                       |
| 7a. Corolla 2.4–3.5 cm long; plant growing in open, disturbed habitats ..... | <i>J. carthaginensis</i> |
| 7b. Corolla 1.1–1.2 cm long; plant growing in shade of moist forests .....   | <i>J. costaricana</i>    |

- 8a. Bracts reddish brown, 16–19 mm long; plants cultivated ..... *J. brandegeana*  
 8b. Bracts green or brown, 4–11 mm long; plants not cultivated ..... 9a  
 9a. Capsules 13–15 mm long; corollas 20–40 mm long ..... 10a  
 9b. Capsules 5–10 mm long; corollas 7–19 mm long ..... 11a  
 10a. Corollas white; bracts small, inconspicuous, 4–6 mm long, linear-subulate .....  
     *J. urophylla*  
 10b. Corollas rose-purple; bract larger, 10–11 mm long, oblanceolate ..... *J. brenesii*  
 11a. Leaf bases rounded to subcordate; leaves sessile to subsessile ..... *J. skutchii*  
 11b. Leaf bases acuminate, acute or obtuse; leaves with petioles mostly more than 5 mm long (except *J. refractifolia*) ..... 12a  
 12a. Calyx glandular-puberulous; lower cell of anther acute or rounded ..... 13a  
 12b. Calyx puberulous or glabrous; lower cell of anther spurred ..... 17a  
 13a. Bracts of inflorescence 4–6 mm broad; peduncles lacking glandular hairs .....  
     *J. valerii*  
 13b. Bracts of inflorescence 0.5–2.5 mm broad; peduncles with glandular hairs ..... 14a  
 14a. Corollas 15–19 mm long; calyx segments 5–7 mm long ..... *J. angustibracteata*  
 14b. Corollas 7–11 mm long; calyx segments 2–4.5 mm long ..... 15a  
 15a. Calyx segments (5) equal; spike lax .....  
     *J. tonduzii*  
 15b. Calyx segments not equal (posterior calyx segment setaceous); spike compact ..... 16a  
 16a. Bracts apically obtuse; leaves narrowly elliptical oblong ..... *J. parvibracteata*  
 16b. Bracts apically acute; leaves lanceolate-elliptic ..... *J. pittieri*  
 17a. Leaves no longer than 6.5 cm; posterior calyx segment much shorter than the rest ..  
     *J. candelariae*  
 17b. Leaves to as long as 18 cm; calyx segments of equal lengths ..... 18a  
 18a. Bracts obovate to elliptic, strigose; corolla 16–17 mm long ..... *J. orosiensis*  
 18b. Bracts ovate, linear-spatulate, spatulate or orbicular, pilose or glandular-puberulous; corolla 7–12 mm long ..... 19a  
 19a. Bracts linear-spatulate, spatulate or orbicular, glandular-puberulous; petioles glabrous .....  
     *J. costaricana*  
 19b. Bracts ovate, pilose; petioles pilose to tomentose ..... *J. refractifolia*  
 20a. Leaves with auriculate bases, sessile to subsessile .....  
     *J. ephemera*  
 20b. Leaves basally attenuate (lacking auricles), petiolate ..... 21a  
 21a. Corolla 12–19 mm long, anther cells superposed; calyx segments 4 ..... *J. metallica*  
 21b. Corolla 30–44 mm long, anther cells subequal; calyx segments 5 ..... 22a  
 22a. Leaves elliptic; corollas narrowly funnelform (not fusiform when unopened) ..... *J. tinctoria*  
 22b. Leaves ovate; corollas fusiform when unopened ..... *J. spicigera*  
 23a. Capsules 4–6 mm long; corollas 4–6 mm long ..... *J. comata*  
 23b. Capsules 7–25 mm long; corollas 8–70 mm long ..... 24a  
 24a. Plant a climbing vine; corollas 65–70 mm long ..... *J. sarapiquensis*  
 24b. Erect herbs or shrubs; corollas 8–60 mm long ..... 25a  
 25a. Shrubs 2–6 m tall; anther cells equal or subequal, but not superposed ..... 30a  
 25b. Herbs mostly less than 1.5 m tall; anther cells superposed ..... 26a  
 26a. Posterior calyx segment shorter, ca. half the length of the others; corollas 25–35 mm long .....  
     *J. oerstedii*  
 26b. Calyx segments of equal lengths; corollas 8–17 mm long ..... 27a  
 27a. Inflorescence a compact spicate panicle resembling a single spike; bracts ovate to elliptic, 6–8 mm long, 2.5–3.5 mm broad ..... *J. orosiensis*  
 27b. Inflorescence a loose spicate panicle; bracts subulate to linear-subulate, 1.5–2 mm long, 0.25–1 mm broad ..... 28a  
 28a. Leaves with auriculate bases, sessile to subsessile .....  
     *J. ephemera*  
 28b. Leaves basally attenuate to rounded, lacking auricles, petiolate ..... 29a  
 29a. Calyx segments 4, ca. 5 mm long; leaves ovate, 1.5–4 cm broad ..... *J. metallica*  
 29b. Calyx segments 5, ca. 2 mm long; leaves lanceolate, 1–2 cm broad ..... *J. pectoralis*

- 30a. Bracts subulate, 1–3 mm long; petioles short, 15 mm or less ..... 31a  
 30b. Bracts linear-lanceolate, elliptic or obovate, 5–14 mm long; petioles long to more than 50 mm long ..... 33a  
     31a. Flowers in axillary cymes; capsules 18–20 mm long ..... *J. macrantha*  
     31b. Flowers in loose spicate panicles; capsules 7–8 mm long ..... 32a  
     32a. Leaves elliptic; corollas narrowly funnelform (not fusiform when unopened) ..... *J. tinctoria*  
     32b. Leaves ovate; corollas fusiform when unopened ..... *J. spicigera*  
 33a. Inflorescences in large, terminal spicate panicles, corollas red with yellow tip; capsules ca. 1.5 cm long ..... *J. crenata*  
 33b. Inflorescences in dense terminal or subterminal thyrses (cymose panicles), corollas yellow; capsules 2–2.5 cm long ..... *J. aurea*

**Justicia angustibracteata** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1227. 1938. *Rhytidglossa microphylla* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 159. 1855, non *Justicia microphylla* Lam., 1791. Figure 7.

**Herb** to 1 m tall, young stem quadrangular; internodes between leaf-bearing nodes 1.5–4.5 cm long, 1.0 mm thick, puberulous along 2 lines. **Leaves** with puberulous to subglabrous petioles to 1 cm long; laminae ovate-lanceolate, 1.5 (2)–5 (6) cm long, 1–1.5 (2) cm broad, apically acuminate, basally acute, margins undulate, glabrous to sparingly and minutely scabrous above, more so on costa and veins, puberulous below. **Inflorescences** in lax terminal spikes to 6 cm long, 1 cm broad excluding corollas; peduncle quadrangular, to 2 cm long, glandular-puberulous, rachis quadrangular, glandular-puberulous; **bracts** imbricate, oblanceolate, 10–11 mm long, 2–2.5 mm broad, ciliate, sparingly puberulous, bracteoles linear, 6.5–8.5 mm long, 0.5–0.75 mm broad, glandular-puberulous. **Flowers** with 5-merous calyx, calyx segments unequal, linear subulate, the posterior segment much smaller, ca. 3.5 mm long, 0.25 mm broad, the other segments 5–6.5 mm long, 0.5–0.75 mm broad, sparingly puberulous-glandular; **corolla** white with purplish markings, 15–19 mm long, 2–2.5 mm broad at base, ca. 3.5 mm broad at the throat, upper lip erect, 6–7 mm long, 5–6 mm broad at base, narrowing to a keeled, rounded apex, lower lip 6.5–7 mm long, 6–7 mm broad at base, 3-lobed, the lobes ca. 2.5 mm long, semioblique; **stamens** exserted, but not beyond the upper lip, anthers strongly superposed, anthers with relatively wide separation, connective 0.5 mm long, anthers 1.0 mm long, 0.5 mm broad, apically and basally acute. **Fruits** clavate, 5–7.5 mm long, 2.25 mm broad, 1–1.5 mm thick, puberulous; seeds 2, flat, ovoid, dark brown, 1.5 mm long, 1.25 mm broad.

Found along streams and on steep slopes through cloud forest areas of Cartago and San José provinces at elevations of 1800 to 2000 m. Flowering collections have been made in January, February, March, and June.

*Justicia angustibracteata* is recognized by its ob-

lanceolate bracts, unequally segmented, five-merous calyx, and white corollas with purplish markings. This species is not easily confused with other *Justicia* species when all of the above features are visible. It bears a superficial resemblance to *J. parvibracteata*, but differs from it in its unequal calyx segments, its longer (10 to 11 mm vs. 4 to 6 mm), oblanceolate bracts (vs. elliptic) and its longer corollas (15 to 19 mm vs. 6.5 to 7.5 mm).

**Justicia aurea** Schlecht., Linnaea 7: 393. 1832, non *Justicia aurea* (Rose) Lindau, Bull. Herb. Boissier. 5: 675. 1897. *Justicia umbrosa* Benth., Pl. hartw. 79. 1841. *Adhatoda umbrosa* Nees in DC., Prodr. 11: 406. 1847. *Jacobinia aurea* Hemsl., Diagn. pl. nov. mexic. 35. 1879, non Hiern, 1877–1878. *Ecbolium umbrosum* Kuntze, Revis. gen. pl. 2: 981. 1891. *Jacobinia umbrosa* Blake, Contr. Gray Herb. 52: 103. 1917. Figure 7.

**A shrub** to 6 m tall, stem subquadrangular to quadrangular in younger portions; internodes between leaf-bearing nodes 2–5 cm long, 4–7 mm thick, puberulous to tomentose. **Leaves** with petioles to 5.7 cm long, pubescence that of the stem; laminae ovate to ovate-elliptic, 11.5–30 (40) cm long, 5.5–12 (17) cm broad, apically acuminate, basally attenuate, margins entire, undulate or crenulate, glabrous to sparingly strigose above, hairs more dense on costa, glabrous to strigose below, cystoliths dense and prominent on both surfaces. **Inflorescences** densely thyrsoid at or near the ends of branches, to 18 cm long, 6 cm thick excluding corollas; **bracts** linear-lanceolate, 11–14 mm long, 1–2 mm broad; bracteoles similar, but slightly smaller, both puberulous. **Flowers** with 5-merous calyx, segments lanceolate, 5.5–7 mm long, 1.5 mm broad at base, puberulous; **corolla** yellow, bilabiate, cylindrical, to 5.5 cm long, 3 mm broad, puberulous-glandular outside, glabrous inside except for bearded throat, the lips ca. 2.5 cm long, upper lip erect, 7 mm broad, apically acute, lower lip 6 mm broad, apically 3-lobed, lobes ca. 1 mm long, apically rounded and slightly hooded, especially the middle lobe; **stamens**

exserted to ca. the tip of the upper lip, anthers 3 mm long, glabrous, the cells unequal, basally acute, filaments stout, ca. 0.75 mm broad, glabrous; ovary 2 mm long, 1 mm thick, glabrous. **Fruit** clavate, puberulous, 2–2.5 cm long, ca. 5 mm broad, 4 mm thick; seeds 4, flattened, suborbicular, ca. 2 mm in diameter, surface roughened.

This is a very attractive shrub, and it is frequently cultivated. In the wild it is a relatively wide-ranging species and is found from southern Mexico to Panama. In Costa Rica it has been collected in all provinces except Limón and Cartago, generally in and adjacent to rain and cloud forest from elevations of 100 to 2000 m.

Flowering collections have been made in all months except May and August.

*Justicia aurea* is recognized by its large, attractive thyrsoid inflorescences with large, yellow corollas (more than 5 cm long), its shrubby habit, and its large leaves with long laminae (to 30 cm or more long). It is not easily confused with other species of *Justicia*.

**Justicia brandegeana** Wassh. & Smith, Fl. Ilus. Catarinense ACAN:102. 1969; *Beloperone guttata* Brandegee, Univ. Calif. Publ. Bot. 4: 278. 1912; non *Justicia guttata* Wall., Pl. asiat. rar. 1: 24. pl. 28. 1830. Figure 9.

**Herb to subshrub**, 1–2 m tall, stems subquadrangular; internodes between leaf-bearing nodes 6–9.5 cm long, 1.5–2.5 mm thick, strigose mostly along 2 lines in older portions. **Leaves** with densely strigose petioles 0.5–1 cm long; laminae ovate-lanceolate, 3–3.5 cm long, 1–1.5 cm broad, margins entire, apically acute to slightly attenuate, apex blunt, basally acute, densely pilose on both surfaces, cystoliths visible on both surfaces although obscured by hairs. **Inflorescences** in terminal and axillary spikes to 6 cm long, 2 cm broad, excluding corollas; **bracts** reddish brown, imbricate, ovate, 16–19 mm long, 11–13 mm broad, apically acute, basally rounded to subcordate, puberulous, ciliolate, bracteoles ovate-elliptic, 12–14 mm long, 5–6 mm broad, apically acute, basally obtuse, puberulous with ciliolate margins, peduncles 5–10 mm long, densely strigose. **Flowers** with 5-merous calyx, segments subulate, ca. 5 mm long, posterior segment 1.25 mm broad basally, others ca. 0.75 mm broad, all densely puberulous; **corolla** white, 3 longitudinal rows of purplish dots in throat, 3.2 cm long, the tube narrow, 2 mm broad at base expanding to only 3.5 mm at the mouth, bilabiate, upper lip erect, 12 mm long, 5 mm broad at base, apically acute, lower lip ca. 11 mm long, 2–3 mm broad, apex of 3 shallow, close, obtuse lobes; **stamens** exerted to the tip of the upper lip, anther cells unequal, the cells superposed ca. 3 mm long, basally spurred, filaments glabrous. **Fruits** clavate, 12 mm long, 4 mm broad, 3.5 mm thick, puberulous; seeds 4, dark brown, subglobose, 3 mm long, 2.5 mm broad, 0.5 mm thick, glabrous.

This plant is native to Mexico and is commonly cultivated in much of Latin America.

*Justicia brandegeana* is recognized by its attractive red bracts. These rather compact inflorescences of reddish bracts give the plant its common name, the shrimp plant. In Costa Rica it is called *camaroncillo*.

**Justicia brenesii** (Leonard) D. Gibson, Fieldiana, Bot. 34: 66. 1972. *Beloperone brenesii* Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1201–1202. 1938. Figure 8.

**Herbs** to 1 m tall, erect or decumbent with branches frequent, occasionally rooting at lower nodes, younger stems quadrangular with dense brownish pilose hairs to 1 mm long at the angles, older stems terete and glabrous; **internodes** between leaf-bearing nodes, 2–9 cm long, 1.5–2.5 mm thick. **Leaves** with petioles to 2.2 cm long, pilose; laminae ovate-elliptic, 3.5–6.5 cm long, 2–3.5 cm broad, apically short-acuminate, basally acute, margins entire with pilose hairs, both surfaces glabrous to sparingly pilose, cystoliths prominent and dense on both surfaces. **Inflorescences** in dense terminal or lateral spikes or spikelike thyrses to 5 cm long, 2.5 cm broad excluding corollas; **bracts** imbricate, oblanceolate, 10–11 mm long, 3.5–4 mm broad, pilose and ciliate; bracteoles of similar shape and length, but 1–2 mm broad, pilose and ciliate. **Flowers** with 5-merous calyx, segments subulate, all ca. 6 mm long, posterior segment 1.5 mm broad at base, lateral segments 1.25 mm broad, anterior segments 1 mm broad, all ciliolate; **corolla** rose-purple, to 2.5 cm long, 2.5 mm broad at base expanding to 5.5 mm broad at the mouth, glandular-puberulous, the lips ca. 10 mm long, the upper lip erect, apically acute and notched, lower lip 3-lobed, lobes ca. 3 mm long, apically obtuse; the **stamens** exerted to just below the tip of the upper lip, anther cells superposed, upper cells ca. 2 mm long, lower cells slightly longer, all cells basally calcareous. **Fruits** clavate, capsules ca. 13 mm long, 4 mm broad, 2.5 mm thick, puberulous, hairs retrorse, seeds not seen.

Found in or adjacent to wet forest areas from 800 to 2200 m elevation. This is apparently an endemic species collected in Alajuela and Heredia provinces on both Caribbean and Pacific watershed zones. Flowering collections have been made in September through April, except March.

*Justicia brenesii* is recognized by its stems with densely pilose angles, its relatively broad, short, and crowded spikes or thyrsi with pilose and ciliate bracts, and its rose-purple corollas. It has some resemblance to *J. carthaginensis*, but differs from it in its generally smaller laminae, long-pilose stems, and pilose and ciliate bracts.

**Justicia candelariae** (Oerst.) Leonard, Carnegie Inst. Wash. Publ. 461: 231. 1936. *Rhytidglossa*

*candelariae* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 158. 1855.  
*Dianthera candelariae* Hemsl., Biol. Centralbl. 2: 517. 1882. Figure 8.

**Herbs** to 45 cm tall, **stems** frequently decumbent, often rooting at the lower nodes, quadrangular, pilose, densely so in younger portions; **internodes** between leaf-bearing nodes, 2.5 cm long, 1–1.5 mm thick. **Leaves** with short petioles 3–10 mm long, pilose; laminae ovate-elliptic to elliptic, 2.5–6.5 cm long, 1–2 cm broad, apically and basally acute, margins entire, glabrous to sparingly pilose above, sparingly pilose beneath, cystoliths visible on both surfaces, more prominent beneath. **Inflorescences** in terminal and axillary spikes to 7 cm long, 1.3 cm broad excluding corollas, peduncles to 2.2 cm long, pilose; **bracts** imbricate, spreading outward at anthesis, elliptic, 6.5–9 mm long, 3.5–5 mm broad, apically obtuse and mucronulate, basally acute, vein pattern prominent, pilose and ciliate; bracteoles narrowly elliptic, ca. 6 mm long, 1.5 mm broad, pilose and ciliate. **Flowers** with 5-merous **calyx**, calyx segments unequal, segments narrowly subulate, posterior segment 2.5–3 mm long, 0.25 mm broad, all others 4–6 mm long, 0.5–0.75 mm broad, ciliolate; **corollas** white to pale purple, ca. 10 mm long, 2 mm broad at base expanding to 2.5 mm at the throat, glabrous, upper lip acute, 3.5 mm long, 2.5 mm broad at base, lower lip 4.5 mm long, 3-lobed, lobes 2 mm long, middle lobe 2.75 mm broad, lateral lobes ca. 2 mm broad, all apically rounded; **stamens** barely exerted, anther cells unequal, ca. 0.5 mm long, upper cell slightly larger, lower cell calcareous. **Fruits** clavate, capsules 7 mm long, 2 mm broad, 1.5 mm thick, puberulous; seeds suborbicular, 1.2 mm in diameter, papillate.

Collected in moist forests including oak forests at elevations of 1200 to 2000 m in provinces of Cartago and adjacent parts of San José. Flowering collections have been made in November, December, January, and April.

*Justicia candelariae* is recognized by its pilose stems, elliptic, subreticulate bracts with ciliate margins, relatively small, inconspicuous corollas (1 cm long or less), and its unequal calyx segments. It bears the same common Spanish name *Zornia* as *Blechum brownei*, which it resembles superficially, but *B. brownei* is found at lower elevations, has a near regular corolla, and has four stamens instead of two. It also has some resemblance in its inflorescence to *Justicia parvibracteata*, which has much longer and narrower leaves, smaller bracts, and a setaceous posterior calyx segment.

**Justicia carthaginensis** Jacq., Enum. syst. pl. 11. 1760, and in L., Syst. veg. ed. 16: 2: 153. 1817.  
*Adhatoda carthaginensis* (Jacq.) Nees in DC., Prodr. 11: 403. 1847. Figure 8.

**Herbs** or **suffrutescent** plants to 1.5 m tall, **stems** tetragonal and grooved in younger portions, sparingly strigose mostly along grooves (sometimes along 2 lines) in younger stems, glabrous in older stems; **internodes** between leaf-bearing nodes, 2–7 cm long, 1–3 mm thick. **Leaves** with petioles 0.5–2.5 cm long, puberulous; laminae ovate to elliptic-ovate, 3–7 (14) cm long, 1.5–4 (6.5) cm broad, apically acuminate, basally attenuate, margins entire, glabrous to strigose on the veins on both surfaces, cystoliths abundant and prominent on both surfaces. **Inflorescences** in terminal and axillary spikes, frequently in clusters of 2 or 3, spikes 2–5.5 cm long, 2–3 cm broad excluding corollas, peduncles short, frequently less than 1 cm long, puberulous; **bracts** imbricate, oblong-spatulate to spatulate, sizes varying from 10 mm long, 4 mm broad near apex to 15 (18) mm long, 7 (8) mm broad at the base of the inflorescence, apiculate, puberulous with glandular hairs toward the apex, margins ciliate; bracteoles similar, but slightly smaller. **Flowers** sessile, calyx with 5 equal segments, segments linear-lanceolate, 8–15 mm long, 1–1.5 mm broad, puberulous, margins white, ciliate; **corolla** rose-purple, 24–35 mm long, sparsely and minutely puberulous outside, ca. 3 mm broad basally, expanding to ca. 5 mm broad at the mouth, tube bearded at 4 points inside just above the ovary, upper lip erect, 15–20 mm long, notched, lower lip 3-lobed, 15–20 mm long, middle lobe ca. 7.5 mm broad, lateral lobes ca. 5.5 mm broad, middle lobe personate; **stamens** exerted ca. 10 mm beyond the mouth of the corolla tube, filaments glabrous, anther cells 2.5–3 mm long, superposed, upper cell 1.5 mm above the lower, lower cell calcareous at base, upper cell blunt. **Fruit** clavate, capsules 13–17 mm long, 5–6 mm broad, 4 mm thick, apically apiculate, puberulous; seeds very dark brown, shiny, suborbicular, 3–3.5 mm in diameter.

Found at lower elevations (0 to 100 m) of Guanacaste and Puntarenas provinces in and adjacent to tropical dry forests, frequently in secondary growth and along roadsides. This plant is found over a wide range from Mexico to South America. It is abundant where found and occurs most often in disturbed habitats. It is most frequently found at lower elevations, but has been collected from as high as 1300 m in some areas, although not above 100 m in Costa Rica. This species exhibits considerable variation in such features as corolla length as well as size, shape, and hairiness of bracts, leaves, and calyx. None of these variations is sufficiently consistent to warrant the designation of new species or varieties.

*Justicia carthaginensis* is recognized by its dense spikes, conspicuous, large (13 to 17 mm long), broad, clavate capsules. Because it is weedy also, it has been confused with *Blechum brownei*, but can be easily distinguished from it in number of stamens (two vs. four), larger, bilabiate corolla, bract shape (oblong-spatulate vs. ovate), and much larger capsule (13 to 17 mm vs. 6 mm).

**Justicia chamaephyton** D. Gibson, Fieldiana, Bot. 34: 67. 1972. *Beloperone variegata* Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica, 9: 189. 1898, and in Pitt., Prim. fl. costaric. 2: 315. 1900. Figure 8.

**Herbs** to 30 cm tall, stems ascending, rooting at lower nodes, younger portion quadrangular, densely puberulous, the hairs retrorse; **internodes** between leaf-bearing nodes, 2.5–4 cm long, 1.5–2.5 mm thick, puberulous. **Leaves** sessile to petioles 1 cm long, petioles puberulous; laminae elliptic, 5–12 (15) cm long, 2.5–5 (6.5) cm broad, apically obtuse to rounded, basally attenuate, margins undulate, glabrous above, puberulous on costa and veins below, drying to a lighter green along the veins above, cystoliths abundant and conspicuous on both surfaces. **Inflorescences** in loose terminal spikes to 8.5 cm long, 4 mm broad (excluding corollas), peduncle to 3 cm long, puberulous, rachis puberulous; **bracts** subulate, 2.5–6 (7) mm long, 1 mm broad, puberulous, bracteoles similar, but ca. 2 mm long, 0.5 mm broad. **Flowers** 1 per bract; **calyx** 4-merous, segments subequal, 5–6 mm long, 0.5 mm broad, puberulous; **corolla** white or cream colored suffused with yellow-green markings, ca. 10 mm long, the tube narrow, 1 mm broad at base, 1.5 mm broad at the throat, puberulous, the upper lip 5–6 mm long, 3 mm broad, minutely bidentate at the tip, the lower lip 5 mm long, middle lobe ca. 2.5 mm broad, lateral lobes 2.5 mm long, 2 mm broad; **stamens** exerted to just beyond the tip of the upper lip, anther cells superposed, the lower calcarate. **Fruits** clavate, 10–11 mm long, puberulous; seeds flat, glabrous, 2.5 mm in diameter.

Collected in and along the margins of moist primary forests from the lowlands of Osa Peninsula and the Golfo Dulce area at near sea level to the Boruca area at ca. 300 m elevation, all in Puntarenas Province. This species is also found in lowland areas of both the Pacific and Caribbean sides of Panama, ranging from the Costa Rican border to near Colombia.

*Justicia chamaephyton* is recognized by its small size, slender, lax spikes, subulate bracts, and laminae with obtuse or rounded bases and apices. Superficially, *J. chamaephyton* resembles *Aphelandra tonduzii*, but in addition to its different flowers, it can be distinguished from it by its obtuse or rounded leaf bases.

**Justicia comata** (L.) Lam., Encycl. 1: 632. 1783.  
*Dianthera comata* L., Syst. nat. 10: 850. 1759.  
Figure 8.

**Herbs** to **suffrutescent** plants to 1 m tall, stems somewhat grooved and hexagonal in younger portions, glabrous to pilose; **internodes** between leaf-bearing nodes,

3.2–7 cm long, 2–2.5 mm thick. **Leaves** sessile; laminæ somewhat variable, ovate, elliptic or elliptic-oblong, 3.5–10 cm long, 2.2–3.5 cm broad, apically acuminate, basally acute, rounded or obtuse, margins entire to slightly undulate, glabrous to sparingly strigose along the costa, cystoliths dense on both surfaces, especially so above. **Inflorescences** in terminal and axillary spicate panicles, the spikes whorled at the rachis nodes, the flowers secund on the peduncle, the rachis and the branches grooved with the branches generally somewhat flattened; rachis and branches puberulous with a few longer glandular hairs; **bracts** subulate, ca. 2 mm long, 0.5 mm broad, keeled; bracteoles similar, slightly shorter. **Flowers** sessile with 5-merous **calyx**, segments equal, lanceolate, 1.5–2 mm long, 0.5 mm broad at the base, glabrous; **corolla** bilabiate, white, purplish, or white with purplish dots or streaks, 4–6 mm long, 0.8 mm broad at base expanding to 1.5 mm broad just above the base, glabrous, tube 3 mm long, the upper lip 3 mm long, 1.8 mm broad at base, apically acute, the lower lip 4 mm long, 1.5 mm broad at base, expanding to 3 mm broad above, 3-lobed at the tip, the lobes about equal, 0.5 mm long, 1 mm broad, apically obtuse; **stamens** exerted ca. 2 mm beyond the corolla mouth, anther cells superposed, ca. 0.3 mm long, filaments pilose toward base, glabrous above. **Fruits** clavate, 4–5 mm long, 1.5 mm broad, 1 mm thick, puberulous; seeds 4, reddish brown, suborbicular, flattened, ca. 1 mm in diameter, papillose.

This is a species found in various disturbed habitats, stream banks, cutover hills, roadsides and along trails. It occurs throughout tropical America and is generally found in lower elevations below 500 m, although one collection (*Standley & Valerio* 51873 f), has been made at La Honduras, San José Province at 1200 to 1500 m. It has been collected from all provinces in Costa Rica. Flowering collections have been made in all months except June, August, and September.

*Justicia comata* is recognized by its spicate panicles that are both terminal and axillary, its small corollas (4 to 6 mm long) and capsules (4 to 5 mm long). It is most easily confused with *J. pectoralis*, which has only terminal spicate panicles, longer corollas (8 to 12 mm long), and capsules (7 to 8 mm long).

**Justicia costaricana** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1229. 1938. Figure 8.

**Herbs** to **suffrutescent** plants to 2 m tall, younger stems quadrangular, older stems terete; **internodes** between leaf-bearing nodes 2 (1)–7 cm long, 2 mm thick, puberulous along 2 lines toward the apex. **Leaves** with glabrous petioles to 2 cm long; laminae ovate to elliptic, 5–15 cm long, 2.5–5 cm broad, apically acuminate, basally acute to obtuse, margins undulate, glabrous, cystoliths visible on both surfaces, but more prominent above. **Inflores-**

cence in loose, axillary spikes to 3 cm long, 1 cm broad, rachis glandular-puberulous, peduncle to ca. 1 cm long, puberulous along 2 lines; **bracts** linear-spatulate, spatulate, or orbicular, 8–10 mm long, 0.5 mm to 8 mm broad, glandular-puberulous, bracteoles linear, 8–10 mm long, 0.25–0.5 mm broad, glandular-puberulous; bracts and bracteoles usually spreading. **Flowers** with 5-merous calyx, segments lanceolate, equal, 5.5–6.5 mm long, 1–1.25 mm broad, puberulous; **corolla** saccate, glandular-puberulous, pale green or greenish yellow with broad dark red or purplish streaks at the upper part of the tube, 11.5–12.5 mm long, 1.5 mm broad basally, expanding immediately to 4 mm broad just above base, bilabiate, upper lip ca. 6 mm long, 6.5 mm broad, apically bilobed, lobes acute, 0.5 mm long, 1 mm broad, lower lip 7–7.5 mm long, lateral lobes 4 mm long, 3.5 mm broad, middle lobe 4.5 mm long, 3.5 mm broad, all lobes apically rounded; **stamens** exerted to just below the upper lip, anther cells superposed, upper cells basally apiculate, 1.5 mm long, 0.75 mm broad, filaments glabrous. **Fruit** not seen.

This is an endemic species of mid-altitudes, 1000 to 1500 m. It grows in the shade of moist forests in both the Pacific and the Caribbean watersheds, including the slopes of the Cordilleras Central, Talamanca, and Tilarán. The collections of *Palmer 144* and *161* (NY) from Monteverde, Puntarenas, have broader bracts, orbicular in shape, which are different from those of all other collections, but are otherwise identical. Flowering collections have been made from January through April.

*Justicia costaricana* is recognized by its spreading, spatulate to orbicular bracts, spreading linear bracteoles, and greenish white, red-throated, saccate corollas. There is variation in the shape of the bracts which requires that other features be examined before identification is confirmed. It may be confused with *J. carthaginensis*, but this species has longer corollas (25 to 30 mm) and grows in disturbed open habitats.

**Justicia crenata** (Leonard) Durkee, Ann. Missouri Bot. Gard., 65: 217. 1978. *Jacobinia crenata* Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1223. 1938. Figure 9.

**Shrub** to 5 m tall, **stem** terete; **internodes** between leaf-bearing nodes 2.5–4 cm long, 2–3 mm thick, glabrous. **Leaves** with petioles to 5 cm long, glabrous; laminae elliptic, 9–24 cm long, 2.5–6 (9) cm broad, apically acuminate, basally acute to attenuate, margins crenate, glabrous, cystoliths visible on both surfaces. **Inflorescences** in large, terminal, spicate panicles to 27 cm long and 15 cm broad, peduncles and rachises puberulous; **bracts** elliptic to obovate, apically rounded to acute, soon deciduous, 5–10 mm long, 2–5 mm broad, sparingly glandular-puberulous; bracteoles similar, but smaller. **Flowers**

with 5-merous **calyx**, the segments linear lanceolate, equal, to 7 mm long, 1.25 mm broad basally, sparingly glandular-puberulous, the margins minutely ciliolate; **corolla** bilabiate, red with yellow tip, to 5 cm long, puberulous glandular, the tube narrow, 3 mm broad at base narrowing to 2 mm broad at the mouth, the lips erect, each to 2.5 cm long, 6 mm broad, gradually narrowing from base to tip, the upper lip apically notched, the lower lip with 3 small lobes at the apex, the lobes each ca. 2 mm long, rounded and hooded apically; **stamens** exerted to the tip of the lobes, the anther cells unequal, each to 2.5 mm long, each slightly spurred basally, the lower cell more so. **Fruit** clavate, 1.5 cm long, glabrous or with a few glandular hairs at the apex.

Found in rain forests of Limón Province, ranging to cloud forests of higher elevations (to 1500 m) of the Cordillera Central region. Also found in similar habitats of adjacent Panama. Flowering collections made in February and May through November, except July.

*Justicia crenata* is recognized by its large, terminal panicles of short spikes, its rounded bracts, and its comparatively large, crenate leaves. It has been confused with *J. urophylla*, which differs in its dense spikes, linear, subulate bracts, entire to undulate leaf margins, and white corolla.

**Justicia ephemera** Leonard, Contr. U.S. Natl. Herb. 31: 606. 1958.

Suffrutescent plants to 2 m tall, **stems** upright, much-branched; **internodes** between leaf-bearing nodes 5–11 cm long, 2–3.5 mm thick, upper internodes tetragonal, glabrous to puberulous along 2 lines. **Leaves** sessile or nearly so; laminae elliptic, 5–17 cm long, 1.3–5.5 cm broad, apically long-acuminate, gradually narrowing to an auriculate base, margins crenulate, glabrous on both surfaces, cystoliths numerous, minute, visible on both surfaces. **Inflorescences** in terminal, lax, spicate panicles or single spikes in early flowering stages, to 10 cm long, peduncles 2–3 cm long, puberulous; floral **bracts** subulate, 2–6 mm long, ca. 1.0 mm broad. **Flowers** with 5-merous calyx, **calyx** segments subulate, 2.5 cm long, ca. 0.75 mm broad, sparingly ciliolate; **corolla** white, bilabiate, 10–13 mm long, 2 mm broad basally, glabrous, the lips equal, 8–9 mm long, the upper lip ovate, apically bidentate, 3.5–4 mm broad, lobes of lower lip ovate, apically obtuse, 2.5–3 mm broad, middle lobe grooved and laterally sculpted to form a nectar guide, slightly broader than lateral lobes; **stamens** exerted to ca.  $\frac{1}{4}$ – $\frac{1}{3}$  the length of the corolla lobes, 3.5 mm long, glabrous, anthers moderately superposed, 1 mm long, apically and basally obtuse. **Fruits** not observed.

This species is found in wet areas of rain forests in Colombia, Panama, and Costa Rica. One Costa Rican collection, (*Allen 5223, US*), is known from

Puntarenas Province along the banks of the Río Grande de Téraba, on the trail from Palmar Norte to Caña Blanca, at an elevation of 0 to 100 m. This flowering collection was made in late March. Flowering collections from Panama and Colombia were also made in late March or April.

*Justicia ephemera* is recognized by its elliptic leaves with auriculate bases and small (10 to 13 mm long), white corollas with barely exerted stamens on broad, lax, spicate panicles. Because of its unusually shaped leaves, it is not easily confused with other Costa Rican species of *Justicia*.

**Justicia macrantha** Benth., Pl. hartw. 78: 1839.

Figure 9.

**Shrub** to 3 m tall, older stems terete, quadrangular toward apex; **internodes** between leaf-bearing nodes 2–6 cm long, 1.5–3.5 mm thick, pilose to glabrate. **Leaves** with petioles to 1.5 cm long; **laminæ** elliptic, 6–16 (19) cm long, 2.5–5.5 (6) cm broad, apically acuminate, basally attenuate, margins crenulate, glabrous on both surfaces except for pilose hairs in some, both surfaces frequently gland-dotted, glands more abundant below, cystoliths abundant on both surfaces. **Inflorescences** in axillary cymes; **bracts** and bracteoles subulate, 2–3 mm long, ca. 1 mm broad basally, glabrous, peduncles to 4.5 cm long, glabrous to sparingly pilose; pedicels 3–5 mm long, glabrous. **Flowers** with 5-merous calyx, segments subulate, 3–4 mm long, ca. 1 mm broad basally, keeled, glabrous, usually ciliolate; **corolla** orange red to yellowish, 4.5–5.5 cm long, deeply bilabiate, glabrous, the tube funnelform, basally 4 mm broad, 8 mm broad at the mouth, both lips ca. 2.8 cm long, the upper lip erect, 8 mm broad, apically dentate in 2 short lobes and hooded to enclose part of the style, the lower lip spreading, 1 cm broad, 3-lobed at the tip, the lobes about equal, 4 mm long, apically rounded; **stamens** exerted to just below the tip of the upper lip, the anthers pendulous, converging apically and diverging basally, the cells 2.5 mm long, slightly unequal, basally rounded, the filaments stout, 1 mm broad, glabrous. **Fruits** clavate, 18–20 (22) mm long, 4 mm broad, 2.5 mm thick, puberulous; seeds oval, flattened, 3 mm long, 2 mm wide, roughened.

This species is found through most of Central America in forests at altitudes above 500 m. In Costa Rica it has been collected in cloud forests as high as 1750 m, including the Cordilleras Guanacaste, Tilarán (Monteverde), Central, and Talamanca. It has been collected in all provinces except Limón. Flowering collections have been made from November through April, excluding March.

*Justicia macrantha* is recognized by its axillary cymes with large colorful corollas, which are strongly bilabiate, and its pendulous anthers with cells lacking spurs. It has been confused with *J.*

*secunda*, which has mostly terminal inflorescences which are thyrsoid (cymose panicles) or paniculate, shorter corollas (2.5 to 4.3 cm long), upright anthers, and shorter capsules (ca. 1 cm long).

**Justicia metallica** Lindau, Anales Inst. Fís.-Geogr.

Nac. Costa Rica, 9: 189. 1898, and in Pitt., Prim. fl. costaric. 2: 311. 1900. Figure 9.

**Herb** to 1 m tall, stem ascending, rooting at the lower nodes, younger stems quadrangular, the angles rounded, pilosulus in 2 lines, mixed with glandular hairs toward the apex, purplish; **internodes** between leaf-bearing nodes 1.5–6.5 cm long, 1–2 mm thick. **Leaves** with petioles 3–10 (15) mm long, pubescence of petioles that of the stem; **laminæ** ovate, 3–9 (12) cm long, 1.5–4 (6) cm broad, apically acuminate to short acuminate, basally sparingly attenuate to rounded, margins entire, undulate or crenate, glabrous to sparingly strigose along the midrib and the costa, the cystoliths prominent on both surfaces, dried leaves greenish above, shiny metallic blue beneath. **Inflorescences** of lax, terminal or axillary, spicate panicles, the spikes ca. 8 cm long, the first internode ca. 1 cm long, the peduncles and rachises glandular-puberulous, purplish; **bracts** and bracteoles linear subulate, to 1.5 mm long, 0.25 mm broad basally, glandular-puberulous. **Flowers** with a 4-merous calyx, calyx segments subulate, to 5 mm long, ca. 0.5 mm broad basally, glandular-puberulous; **corollas** pink to purplish, 12–14 mm long, sparingly puberulous, the tube cylindrical, to 9 mm long, 2 mm broad, the upper lip erect, to 4.5 mm long, 2 mm broad, apically minutely bidentate, the lower lip spreading, to 5.5 mm long, the lobes to 2 mm long, the middle lobe 2 mm broad, the lateral lobes 1.5 mm broad, all apically rounded; **stamens** exerted to just below the tip of the upper lip, the anther cells superposed, ca. 1 mm long, the lower cell spurred. **Fruits** clavate, capsules 7–8 mm long, ca. 2 mm broad, 2 mm thick, sparingly puberulous; seeds reddish brown, suborbicular, 1.5 mm in diameter, roughened.

Found along stream banks and in wet places of rain forests at elevations generally under 600 m. This species has been collected in much of Panama and in adjacent Costa Rica on the Pacific slope, mostly in the vicinity of the basin of the Río General and the Osa Peninsula. Flowering collections have been made in Costa Rica in January and February.

*Justicia metallica* is recognized by its leaves with shiny blue metallic undersides, its purplish stems and rachises, its four-parted calyx, and its lax spicate panicles. It is not easily confused with other species of the genus.

**Justicia oerstedii** Leonard, Publ. Field Mus. Nat.

Hist., Bot. Ser. 18: 1230. 1938. Figure 9.

**Herb** to **suffrutescent** plant, 1.5 m tall, **stems** erect, terete to subquadangular when young; **internodes** between leaf-bearing nodes, 1.5–4.5 cm long, 0.75–1.25 mm thick, glabrous to puberulous. **Leaves** with petioles to 5 mm long, petioles glabrous; laminae elliptic to ovate, 3–10 (12) cm long, 1–2.5 (3) cm broad, apically acuminate to acute, basally attenuate, margins entire to undulate, glabrous on both surfaces, cystoliths prominent on both surfaces. **Inflorescences** in terminal spicate panicles to 20 cm long, the spikes lax, the peduncles and rachises glandular-puberulous; **bracts** and bracteoles narrowly subulate, 1–1.5 mm long, ca. 0.5 mm broad basally, puberulous. **Flowers** with 5-merous calyx, the calyx segments subulate, 3–4 mm long, 0.5 mm broad, the posterior segment smaller, 1.5–2 mm long, 0.25 mm broad, all segments keeled, puberulous; **corolla** bright red, 2.5–3.5 cm long, puberulous, the tube narrow, 1 mm broad basally, 5–6 mm broad at the mouth, the upper lip oblong, to 9 mm long, 5 mm broad, apically minutely bidentate, the lower lip to 10.5 mm long, 3-lobed, the middle lobe 2.5 mm broad, the lateral lobes 1.5 mm broad, all lobes to 3 mm long, apically rounded; **stamens** exserted to about the tip of the upper lip, the anther cells superposed by a connective, 0.5 mm broad, the lower cell rounded, acute at the base. **Fruits** clavate, to 12 mm long, 2 mm broad, puberulous; seeds suborbicular, flattened, ca. 1.5 mm in diameter, roughened.

This species is abundant where found in rain forest and cloud forest areas in moist, shaded locations along streams and trails at elevations of 500 to 1800 m in Costa Rica and Panama. In many locations this is the most abundant herb in flower. In Costa Rica it is found mainly on the Pacific watershed areas of all the cordilleras from Panama to the Cordillera Guanacaste. It has not been collected in Limón Province. Flowering collections have been made from December through April.

*Justicia oerstedii* is recognized by its bright red flowers with corollas more than 2 cm long, its lax, spicate panicles with glandular-puberulous rachises, and its five-parted calyx with one segment much shorter than the others. It may be confused with *J. macrantha*, which differs in its longer corolla (more than 4 cm long), its axillary, cymose inflorescences, and its four-parted calyx.

#### **Justicia orosiensis** Durkee, sp. nov. Figure 9.

Herbae vel suffrutescences, usque ad 1.2 m altae, caulis erectis et diffusis. Folia petiolata, laminis ellipticis, 8–23 cm longis, 2–7 cm latis, apice acuminatis, basi attenuatis, supra glabris, inferne plerumque glabris, cystolithis nullis. Inflorescentiae paniculatae spiciformes, compactae, terminales, bracteis laxe imbricatis, obovatis vel ellipticis, 6–8 mm longis, bracteolis similibus bractearum sed minoribus. Flores virello-albi ad lilacini, corollis 12–

14 mm longis, staminibus exsertis. Fructus clavati, 12–14 mm longi, seminibus 4.

**Herbs** to **suffrutescent** plants to 1.2 m tall, **stems** erect, but diffuse, quadrangular when young and dark maroon, **internodes** between leaf-bearing nodes, 1.5–9.5 cm long, 1.5–3.5 mm thick, glabrous to sparingly puberulous. **Leaves** with glabrous to sparingly puberulous petioles 1–2 cm long; laminae elliptic, 8–23 cm long, 2–7 cm broad, apically acuminate, basally attenuate, margins entire to slightly undulate, glabrous above, glabrous to sparingly puberulous along costa below, cystoliths obscure on both surfaces. **Inflorescences** in compact terminal, spicate panicles superficially resembling single spikes, 7–11 cm long, 1.5–2 cm broad excluding corollas, peduncles and rachises strigose; **bracts** and bracteoles obovate to elliptic, bracts loosely imbricate, 6–8 mm long, 2.5–3.5 mm broad, apically obtuse to rounded, basally attenuate, strigose mostly at base, bracteoles similar although slightly smaller. **Flowers** with 5-merous calyx, the calyx segments subulate, 6–7 mm long, 1.25–1.5 mm broad, glabrous; **corolla** greenish white to lilac, 16–17 mm long, secund, glabrous, the tube cylindrical, 6 mm long, 2 mm broad, the upper lip curved, oblong, partially enclosing the stamens, to 11 mm long, 6 mm broad, apically notched, the lower lip to 9.5 mm long, 3-lobed, the middle lobe 4 mm broad, the lateral lobes 3 mm broad, all lobes to 7 mm long, apically rounded; **stamens** exserted to about the tip of the upper lip, the anther cells superposed, 2.5 mm long, the lower cell calcareous, the upper cell with apiculate base, pollen is 4-porate. **Fruits** clavate, 12–14 mm long, 4–5 mm broad, 3.5–4 mm thick, glabrous; seeds 4, suborbicular, ca. 3 mm in diameter.

**TYPE**—Costa Rica; Cartago Prov., 10 km south of Tapantí, elevation 1600 m, in primary forest high over Río Grande de Orosi, Lent 954 (holotype, F). Additional collections: Cartago Province, forested slopes above Platanillo, elevation 1000 m, Wilbur and Stone 10611 (DUKE); along stream near Tausito, elevation 1400 m, Lent 3818 (CR, F). Flowering collections were made in mid-May, late August, and February.

*Justicia orosiensis* is recognized by its compact spicate panicles superficially resembling spikes and its secund, greenish white corollas. It may possibly be confused with the much more common and wide-ranging *J. carthaginensis* of disturbed habitats, which differs further in its dense spikes, larger rose-purple corollas (24 to 35 mm long vs. 16 to 17 mm long), and larger (25 to 35 mm long), oblong-spatulate to spatulate bracts versus the 6- to 8-mm long, obovate to elliptic bracts of *J. orosiensis*.

#### **Justicia parvibracteata** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1231. 1938. Figure 10.

Erect herb to 35 cm tall, stems quadrangular, terete in older portions; internodes between leaf-bearing nodes 1–4 cm long, 1 mm thick, puberulous mostly along 2 lines. Leaves with puberulous petioles to 8 mm long; laminae narrowly elliptic-oblong, 3.5–7 cm long, 0.7–1.2 cm broad, margins entire to undulate, apically acute, basally attenuate, cystoliths prominent on both surfaces, glabrous. Inflorescences in terminal and axillary spikes or subpanicle spikes to 6 cm long, 6 mm broad excluding corollas; bracts barely imbricate, elliptic to obovate, 4–6 mm long, 1–2 mm broad, apically obtuse, apiculate, veins prominent, bracteoles narrowly elliptic, 3–4 mm long, 0.5–0.75 mm broad, sparingly ciliolate, peduncles 0.5–2.5 cm long, puberulous mostly along 2 lines, rachis glandular-puberulous. Flowers in fascicles of 2–4 per bract; calyx 5-merous, posterior segment setaceous, 1.5–2.5 mm long, the remainder lanceolate, 3.5–4.5 mm long, ca. 0.5 mm broad, all glandular-puberulous, corolla white, 7.5–8 mm long, 1.5 mm broad basally, expanding to 2 mm broad at the mouth, sparingly puberulous, upper lip 3.5–4 mm long, 2 mm broad basally, apically acute, lower lip 4–4.5 mm long, 2 mm broad, 3-lobed, lobes 1 mm long, ca. 1.5 mm broad, apically rounded; stamens exerted to ca. ½ the length of the upper lip, anther cells superposed, ca. 0.5 mm long, lower one slightly smaller, rounded basally. Fruits clavate, 4.5–5.5 mm long, 1–1.25 mm broad, 1–1.25 mm thick, sparingly puberulous, seeds reddish brown, ovate, 1 mm long, 1 mm wide, papillate.

Found in wet areas along streams and river banks on the Caribbean slope of the Cordillera Central and on steep forested slopes of the Osa Peninsula, at altitudes of 450 to 1400 m. Flowering collections have been made from January through March.

*Justicia parvibracteata* is recognized by its narrow spikes with small (4 to 6 mm long), elliptic to obovate bracts with narrow apices, short, white, inconspicuous corollas (less than 1 mm long), and its narrowly elliptic-oblong laminae. It has some resemblance to *J. candelariae* and *J. valerii*, but can be distinguished from these by its smaller bracts (4 to 6 mm long vs. 6 to 10 mm) and narrower leaves.

**Justicia pectoralis** Jacq., Enum. syst. pl. 11. 1760.  
Figure 10.

Herbs to 2 m tall, stems weak, erect or ascending, subquadrangular, grooved; internodes between leaf-bearing nodes 2–4.5 mm long, 1–2 mm thick, retrorse hairs mostly along 2 lines. Leaves with short strigose petioles to ca. 5 mm long; laminae narrowly to broadly lanceolate, 4–8 (10) cm long, 1–2 (2.5) cm broad, margins entire to undulate, apically acuminate, basally acute to obtuse, cystoliths dense and prominent above, not visible beneath, glabrous to strigose at the costa above, glabrous beneath. Inflorescences in terminal, lax, spicate

panicles to 25 cm long, 15 cm broad, the lower internodes of spicate branches ca. 2 cm long, rachises and peduncles glandular-puberulous; bracts and bracteoles subulate, 2 mm long, 1 mm broad basally, puberulous with a few glandular hairs. Flowers with a 5-merous calyx, segments narrowly subulate to 2 mm long, 0.5 mm wide, basally glandular puberulous; corollas white, lilac or purple, 8–12 mm long, puberulous outside, the throat transversely plicate, often spotted with dark purple, the tube narrowly funnelform, basally 1.25 mm broad, 2.5 mm broad at the mouth, the upper lip erect, triangular 3.5 mm long, 3 mm broad, apically acute, the lower lip spreading, to 5 mm long, 3-lobed, the lobes 1 mm long, the middle lobe 2 mm broad, the lateral lobes 1.5 mm broad, all apically obtuse; stamens exerted to about the tip of the upper lip, the anther cells slightly superposed, basally apiculate, the filaments glabrous. Fruits clavate, capsules 7–8 mm long, 1.5–2 mm broad, ca. 1 mm thick, puberulous; seeds orbicular, flattened, 1.5 mm in diameter.

This is a wide-ranging species of roadsides and waste places in tropical America. In Costa Rica it occurs from near sea level to 900 m altitude and has been collected in all provinces except Alajuela. Flowering collections have been made from January through May.

*Justicia pectoralis* is recognized by its terminal spicate panicles, with corollas 8 to 12 mm long, puberulous capsules 7 to 8 mm long, and lanceolate laminae 4 to 8 mm long. It is most easily confused with *J. comata*, but can be distinguished from it by its terminal spicate panicles (vs. terminal and axillary spicate panicles), longer corollas (8 to 12 mm vs. 4 to 6 mm long), and longer, puberulous capsules (7 to 8 mm long vs. papillose capsules, 4 to 5 mm long).

**Justicia pittieri** Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica 9: 189. 1898, and in Pitt., Prim. fl. costaric. 2: 312. 1900. Figure 10.

Herbs to 50 cm tall, stems ascending, younger stems quadrangular, grooved, retrorse hairs mostly along 2 lines; internodes between leaf-bearing nodes 5.5–7 cm long, 1.5–2 mm thick. Leaves petiolate, petioles short, 1–10 mm long, strigose; laminae lanceolate-elliptic, 5–12 cm long, 2–3 cm broad, margins entire, apically acuminate, basally acute, glabrous to sparingly strigose, cystoliths dense and prominent on both surfaces. Inflorescences in terminal and axillary spikes, to 15 cm long, 1 cm broad, excluding corollas, rachises and peduncles with retrorse pubescence mostly along 2 lines, plus some glandular hairs, peduncle to 11 cm long, bracts imbricate, spreading at anthesis, elliptic, 4.5–5.5 mm long, 1.5–2.2 mm broad, apically and basally acute, subglabrous, glandular-puberulous, ciliate, bracteoles elliptic, 3.5–4 mm long, 0.5–0.75 mm broad, glandular-puberulous, ciliate. Flow-

ers in fascicles of 2–3 per bract, calyx 5-merous, posterior segment setaceous, 2 mm long, remaining segments subulate, 3.5–4.5 mm long, 0.5–0.75 mm broad, glandular-puberulous; corollas white with purple dots, 7–9 mm long, 1 mm broad at the base expanding to 2.25 mm broad at the mouth, puberulous with a few glandular hairs, the throat transversely plicate, the plait purplish, upper lip 5 mm long, 2 mm broad basally, apically bidentate, lower lip 3.5 mm long, the lobes orbicular, ca. 1 mm in diameter; stamens exerted ca. ½ the length of the upper lip, anther cells superposed, ca. 0.5 mm long, basally obtuse, lower cell slightly smaller. Fruits not seen.

Only two collections of this species have been observed: the type, Pittier 8642 (CR) from lowland rain forests of the upper Rio Yorkín between Costa Rica and Panama and Skutch 4652 (F, MO) at 600 to 850 m altitude in the vicinity of Pejibaye (Pejivalle), Cartago Province. These flowering collections were made in January and March.

*Justicia pittieri* is recognized by its inflorescences with elliptic bracts (4.5 to 5.5 mm long), which spread at anthesis, flowers in fascicles of two to three per bract, unequal calyx segments, and stems with retrorse hairs mostly along two lines. *Justicia pittieri* may be confused with *J. tonduzii*, but differs from it in its unequal calyx segments, elliptic bracts (vs. oblanceolate), and glabrous to sparingly strigose leaves (vs. pilose).

**Justicia refractifolia** (Kuntze) Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1232. 1938. *Ecbolium refractifolium* Kuntze, Revis. gen. pl. 2: 487. 1891. *Justicia pseudopolystachia* Cuf., Arch. Bot. Sist. 10: 49. 1934. Figure 10.

Herbs to suffrutescent plants, 1 m tall, stems simple, erect, subquadangular toward the apex, subterete below; internodes between leaf-bearing nodes 4–10 cm long, 1.75–2.5 mm thick, pilose to tomentose. Leaves with pilose to tomentose petioles to 3 mm long; laminae elliptic to elliptic-obovate, 11–18 (21) cm long, 3–6.5 (8.5) cm broad, margins entire to undulate, apically acuminate, basally acute to attenuate, glabrous to strigose on the costa and veins above, pilose to sparingly strigose beneath, cystoliths prominent to obscure above, obscure beneath. Inflorescences in terminal and axillary spikes, borne singly and in clusters, to 15 cm long, 1 cm broad, the rachis pilose to strigose; bracts ovate, 8–10 mm long, 3.5–5 mm broad, imbricate, apically acute, basally obtuse, drying brown, the veins prominent, sparingly pilose on both surfaces, ciliate; bracteoles lanceolate, slightly falcate, 6.5–9 mm long, 1.5–2 mm broad, puberulous, ciliolate. Flowers with 5-merous calyx, segments narrowly subulate, 5.5–6 mm long, 0.5–0.75 mm broad, puberulous, ciliolate; corolla white to purple, the tube cylindrical, 7–8 mm long, 1.5 mm broad, puberulous, the upper lip erect, ca. 4–4.5 mm long, 2 mm broad, apically bidentate, lower lip 4–5 mm long, 3-lobed, the

lobes 2–2.5 mm long, apically obtuse, the middle lobe 2–2.5 mm broad, the lateral lobes 1.5–2 mm broad, the stamens exerted to ca. the tip of the upper lip, the filaments attached to the tube just below the mouth, pubescence of minute glandular hairs, the anther cells superposed, the upper cell mucronate, the lower cell spurred. Fruits clavate, capsules 7.5–10 mm long, 2 mm broad, 2 mm thick, puberulous; seeds ovate, ca. 1.5 mm long, 1.5 mm broad, flattened, roughened.

Found at lower elevations frequently in moist, disturbed areas that are shaded in both Costa Rica and Panama. It has been collected only in the Caribbean lowlands of Costa Rica. Flowering collections have been made in November, December, and July.

*Justicia refractifolia* is recognized by its axillary spikes with small, imbricate, ovate bracts which are brown when dried and have a prominent reticulate venation and ciliate margins; its small, relatively inconspicuous flowers (ca. 15 mm long) with superposed anther cells that are spurred only on the lower cell; and its rather large (11 to 18 cm long), elliptic-obovate leaves. *Justicia refractifolia* has some resemblance to *J. refulgens*, but can be distinguished from it by its unbranched spikes (vs. trifurcate spikes), ovate ciliate bracts (vs. lanceolate without cilia), and longer bracts (8 to 10 mm vs. 6 mm long).

**Justicia sarapiquensis** McDade, Syst. Bot. 7: 489–493. 1982. Figure 10.

Suffrutescent vine climbing to 15 m; internodes between leaf-bearing nodes 1.5–2.5 cm long, 2–2.5 mm thick, subquadangular, sparingly puberulous, older stems terete. Leaves with sparingly puberulous petioles 5–10 mm long; laminæ ovate, 4.5–7.7 cm long, 2.2–3.5 cm broad apically acuminate, basally obtuse to rounded or slightly cordate, margins entire, glabrous on both surfaces, cystoliths prominent on both surfaces. Inflorescences in lax, terminal panicles of up to 15 flowers, peduncles and branches sparingly puberulous; bracts subtending the flowers borne singly or in pairs, ovate, magenta, 15–21 mm long, 14–16 mm broad, apically obtuse, glabrous, bracts on lower parts of peduncle smaller; bracteoles 2 per flower, lanceolate, magenta, 16–19 mm long, 6–10 mm broad, apically acute, glabrous. Flowers with 5-merous calyx, calyx lobes equal, 15–22 mm long, 2–4 mm broad, white, apically acute and apiculate, glabrous; corolla white, 6.5–7 cm long, outside with fairly dense white pilose hairs 1–1.5 mm long, the tube 38–40 mm long, 5–6 mm broad at base, narrowed to 2.5–3 mm broad above the ovary, expanding to 5–6 mm broad at the throat, the upper lip erect, 23–26 mm long, apically acute, the lower lip slightly reflexed at anthesis, 27–29 mm long, apically 3-lobed, each lobe 3–4 mm long; stamens extending to just below the upper lip, anther cells slightly superposed, ca. 4 mm long. Fruits

clavate, dark brown, 15–20 mm long, 5–6 mm broad, 3–4 mm thick, glabrous, floral bracts, bracteoles, and calyx are strongly reflexed when fruits are mature; seeds 4, orbicular, flattened, 3–4 mm in diameter, glabrous.

This species grows in shaded areas of the rain forest lowlands of northern Costa Rica at elevations of 100 to 575 m. It has been collected in only two sites, near Quesada (Villa Quesada), San Carlos, and the La Selva Research Station, both in Heredia Province. Flowering collections have been made in March.

*Justicia sarapiquensis* is recognized by its viny habit, its large magenta bracts and bracteoles, its white calyx, and its white, pilose corolla. It is not easily confused with other species of *Justicia* from Costa Rica; however, the Panamanian species, *J. graciliflora* (Standley) D. Gibson, has a viny habit, but lacks the large, showy bracts and bracteoles.

**Justicia skutchii** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1234. 1938. Figure 10.

**Shrub** to 1 m tall, stems quadrangular, older portions terete; **internodes** between leaf-bearing nodes 1–3.5 cm long, 1.5–2 mm thick, densely pilose. Leaves sub sessile; laminae ovate-elliptic, 3.5–13 cm long, 3.5–5 cm broad, margins entire to slightly undulate, apically acuminate, basally rounded or subcordate, cystoliths prominent on both surfaces, sparingly pilose above, pilose beneath. **Inflorescences** in terminal spicate panicles, spikes lax, to 9.5 cm long, 8 mm broad excluding corollas, peduncle and rachis pilose-glandular, **bracts** elliptic, 3.5–4 mm long, 1 mm broad, sparingly puberulous, ciliolate, bracteoles linear, 3–3.5 mm long, ca. 0.25 mm broad, sparingly glandular-puberulous. **Flowers** in clusters of 2–3 per bract, **calyx** 5-merous, posterior segment setaceous, 3.5–4 mm long, puberulous, other segments subulate-linear, 3.4–5 mm long, 0.5 mm broad, puberulous; **corolla** white and purple, glabrous, 7.5–9 mm long, tube cylindrical 4.5–5 mm long, 2 mm broad, upper lip acute, ca. 3 mm long, 2 mm broad, lower lip ca. 3 mm long, lobes 0.5 mm long, rounded, lateral lobes 1.25 mm broad, middle lobe 2 mm broad; **stamens** exerted to ca. ½ the length of the upper lip, cells unequal, 0.5 mm long, basally acute. **Fruits** clavate, capsules 8.5–9 mm long, 2 mm broad, 2 mm thick, puberulous, seeds reddish brown, ovate, 1.75 mm long, 1.5 mm broad.

Found in moist habitats on rocks along a stream in a forest in the vicinity of General Viejo (El General), San José Province, at 915 m elevation. Known only from the type collection, *Skutch 3012* (MO).

*Justicia skutchii* is recognized by its lax, spicate panicles with small (3.5 to 4 mm long), elliptic bracts, dense yellowish pilose hairs on the stem,

and basally rounded to subcordate leaves. It resembles *J. tonduzii*, but can be distinguished from it by its leaves with rounded to subcordate bases (vs. obtuse or narrowed bases) and its longer capsules (8.5–9 mm long vs. 5 mm).

**Justicia spicigera** Schlecht., Linnaea 7: 395. 1832.

*Jacobinia spicigera* (Schlecht.) L. H. Bailey, Stand. Cycl. Hort. 1715. 1915. Figure 11.

Erect or scandent shrub, 1–1.5 m tall; internodes between leaf-bearing nodes 1–5 cm long, 1–2 mm thick, quadrangular, glabrous to puberulous along 2 lines. Leaves with petioles 5–10 mm long, petioles mostly puberulous along 2 lines; laminae ovate, 6.5–17 cm long, 3.5–9 cm broad, apically acuminate, basally attenuate, margins entire to undulate, cystoliths abundant and prominent on both surfaces, dried leaves often purplish black. Inflorescences in terminal and axillary spicate panicles, flowers secund, peduncles and rachises puberulous; **bracts** and bracteoles subulate, 1–1.5 mm long, glabrous. Flowers with a 5-merous calyx, calyx segments subulate, 2.5–3 mm long, 0.75–1 mm broad basally, glabrous; corollas orange, 3.5–4.4 cm long, appearing fusiform before opening, glabrous, the upper lip erect, ca. 15 mm long, 6.5 mm broad, apically acute, the lower lip ca. 15 mm long, 5 mm broad, frequently rolled up, lobes small, suborbicular, 1.5 mm long, 1.5 mm broad; stamens exerted approximately to the tip of the upper lip, the anther cells subequal, ca. 2.5 mm long, basally apiculate. Fruits not seen.

Found along stream banks in thickets and forests of Mexico and Central America, this plant is often cultivated for use as laundry bluing and in some areas as a dye. Only one collection of this plant, *Skutch 4809* (F, MO, NY), has been made in Costa Rica, in the Río General basin in March. It had abundant flowers, but no fruits.

*Justicia spicigera* is recognized by its frequently darkened, ovate leaves, axillary spicate panicles with secund flowers, and orange corollas (3.5 to 4.4 cm long) which are fusiform when unopened. It is easily confused with *J. tinctoria*, which is also cultivated for the same purposes, but can be distinguished from it by its fusiform corollas (vs. narrowly funneliform) and its larger, ovate leaves (6.5 to 17 cm long vs. elliptic leaves 4.5 to 14 cm long).

**Justicia tinctoria** (Oerst.) D. Gibson, Fieldiana,

Bot. 34(6): 74. 1972. *Sericographis tinctoria* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 150. 1855. *Jacobinia tinctoria* (Oerst.) Hemsley, Biol. Centralbl. 2: 552. 1882. Figure 11.

**Shrubs** to 2 m tall, younger stems subquadrangular, the angles rounded; **internodes** between leaf-bearing nodes 1.5–5 cm long, 1.5–2.5 mm thick, glabrous. **Leaves** with glabrous petioles to 1.2 cm long; laminae elliptic, 4.5–14 cm long, 1.5–4.5 cm broad, margins entire to undulate, apically acute to acuminate, basally attenuate, cystoliths visible on both surfaces, but more prominent below. **Inflorescences** in lax axillary spikes or spicate panicles with secund flowers, occasionally branched, spikes to 4 cm long, peduncles to 2 cm long, glabrous to puberulous; rachis subquadrangular, internodes 4–5 mm long; **bracts** and bracteoles subulate, 1–2 mm long, 0.5–1 mm broad at base. **Flowers** with 5-merous calyx, calyx segments subulate, 2.25–3 mm long, 1 mm broad at base, glabrous; corolla orange or red, 3–4 cm long, the tube slightly funnelform, 3 mm broad basally, 5 mm broad at the mouth, the lips subequal, ca. 16 mm long, the upper lip erect, 7 mm broad basally, apically acute and keeled, the lower lip oblong, erect or slightly spreading, 4.5 mm broad, apically 3-lobed, the lobes equal, 2 mm long, 1 mm broad, apically obtuse and keeled; stamens exserted to about the tips of the lips, the anther cells subequal, 2.5 mm long, obliquely attached to the connective, mucronulate, filaments glabrous. **Fruits** not seen.

First described from Costa Rica, this species is found in dry thickets of Central America and is often cultivated. When steeped in hot water, its leaves produce a bluing solution, *azul de mata*, used in laundering white clothes. Flowering collections have been made in January, March, April, and June.

*Justicia tinctoria* is recognized by its short axillary spikes with secund flowers, red or orange, narrowly funnelform, corollas (3 to 4 cm long), and short calyx segments (2.25 to 3 mm long). It is easily confused with *J. spicigera*, but can be distinguished from it by its smaller elliptic leaves (4.5 to 14 cm long vs. larger ovate leaves 7–17 cm long), and narrowly funnelform corollas (vs. fusiform corollas).

**Justicia tonduzii** Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica, 9: 189. 1898, and in Pitt., Prim. fl. costaric. 2: 313. 1900. Figure 11.

**Herbs** to 25 cm tall, stem ascending, branching, younger stems terete to subquadrangular, pilose hairs to 3 mm long; **internodes** between leaf-bearing nodes, 2–4 cm long, 1–1.5 mm thick. **Leaves** with pilose petioles to 5 mm long; laminae ovate to ovate-elliptic, 5–8 cm long, 2–3.2 cm broad, margins undulate, apically acuminate, basally obtuse to rounded, pilose on both surfaces, cystoliths dense and prominent on both surfaces. **Inflorescences** in lax terminal and axillary spikes to 7 cm long, rachises and peduncles pilose plus shorter glandular hairs, **bracts** not imbricate at anthesis, oblanceolate, 2.5–3 mm broad, apically acute, pilose, bracteoles linear ca. 2.5 mm long, 0.5 mm broad, pilose. **Flowers** with 5-merous calyx segments equal, subulate, 2–2.5 mm long, glandular-puberulous; corollas purplish, ca. 5–7 mm long, tube cylindrical, ca. 1.5 mm broad, glabrous, the throat longitudinally furrowed, upper lip 2.5 mm long, 1.5 mm broad, apically acute, upper lip 2.5 mm long, 1.5 mm broad, apically 3-lobed, lobes ca. 0.5 mm long, apically rounded; stamens exserted ca. ½ the length of the upper lip, anther cells superposed, upper cell larger, basally acute, lower cell basally rounded. **Fruits** clavate, 6 mm long, 2 mm broad, puberulous, seeds 4, orbicular, 1 mm in diameter.

Only one collection of this species has been observed, Pittier 16073 (US), from the forests of Victoria Farm, plains of Zent, 200 m elevation, Límon Province. This flowering collection was made in January.

*Justicia tonduzii* is recognized by its lax inflorescences, with minute, oblanceolate bracts (2.5 to 3 mm long), equal calyx segments, and long pilose hairs of stem, inflorescence, rachis, and leaves. *Justicia tonduzii* may be confused with *J. pittieri*, but differs from it in its equal calyx segments, oblanceolate bracts (vs. elliptic), and long pilose hairs.

**Justicia trichotoma** (Kuntze) Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1236. 1938. *Ecbolium trichotomum* Kuntze, Revis. gen. pl. 2: 488. 1891. *Justicia asymmetrica* Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica, 9: 189. 1898, and in Pitt., Prim. fl. costaric. 2: 310. 1900. Figure 11.

**Herbs** or small shrubs to 2 m tall, stem erect, subquadrangular, lower portion terete; **internodes** between leaf-bearing nodes 1–5 cm long, 1–2 mm thick, strigose. **Leaves** with strigose petioles to 2 cm long; laminae ovate to ovate-lanceolate, 1 of each pair conspicuously larger than the other, the larger 5–9 cm long, 2–4.5 cm broad, the smaller 2–5.5 cm long, 1–2 cm broad, all apically acuminate, basally attenuate, margins undulate, sparingly strigose to glabrous above, similar below but more dense, cystoliths often inconspicuous, more visible on lower surface. **Inflorescences** in small, axillary cymes, peduncles to 2.7 cm long, strigose; **bracts** and bracteoles subulate, to 1.5 mm long, 0.5 mm broad basally, strigose. **Flowers** sessile, calyx 5-merous, segments narrowly subulate, to 6 mm long, 1 mm broad, puberulous; corolla white, pink or violet, 16–20 mm long, puberulous, the tube funnelform, 1.5 mm in diameter basally, expanding to 4 mm in diameter at the mouth, upper lip to 6 mm long, 4 mm broad, apically acute with a rounded apex, lower lip to 7 mm long, 3-lobed, lobes 3 mm long, apically obtuse, middle lobe 2.5 mm broad, lateral lobes 2 mm broad; stamens exserted to about the tip of the upper lip, anther cells superposed, lower cells calcarate. **Fruits** clavate, to 11 mm long, 2.5 mm broad, 1 mm thick, puberulous; seeds 4, dark brown, suborbicular, ca. 2 mm in diameter, roughened.

Found in wet habitats adjacent to streams, in clearings of rain forests and wet thickets in Panama and Costa Rica, mostly at elevations below 1000 m. In Costa Rica collections have been made only in the Caribbean watershed. Flowering collections have been made in February, March, April, and June.

*Justicia trichotoma* is not easily confused with other species in the genus, because of the unequal size of the leaf pairs.

**Justicia urophylla** (Lindau) D. Gibson, Fieldiana, Bot. 34: 74. 1972. *Beloperone urophylla* Lindau, Anales Inst. Fis.-Geogr. Nac. Costa Rica, 9: 189. 1898, and in Pitt., Prim. fl. costaric. 2: 316. 1900. Figure 11.

**Shrub** to 2 m tall, stems subterete; internodes between leaf-bearing nodes 2–7 cm long, 1.5–2.5 mm thick, glabrous to sparingly puberulous in 2 lines. Leaves with petioles to 3 cm long, pubescence that of the stem; laminae ovate-elliptic, 4.5–13 cm long, 2–5 cm broad, margins entire to undulate, apically acuminate, basally attenuate, glabrous, cystoliths dense, plainly visible on both surfaces. Inflorescences in 1–several dense terminal spikes to 6 cm long, ca. 6 mm broad excluding corollas, the peduncles to 2 cm long, puberulous mostly along 2 lines, the rachis glabrous to puberulous; bracts imbricate, linear-subulate 4–6 mm long, ca. 1 mm broad basally, puberulous, ciliolate, bracteoles triangular, ca. 1 mm long, 0.5 mm broad basally, puberulous. Flowers imbedded in the rachis, calyx segments 5, equal, subulate, 2–3 mm long, ca. 0.5 mm broad, puberulous; corolla white, 3–4 cm long, puberulous, the tube slightly funnelform, 2 mm broad basally, narrower just above the ovary, ca. 3 mm broad at the mouth, the lips 11–16 mm long, the upper lip erect, apically bidentate, the lower lip 3-lobed, the lobes 7–10 mm long, the middle lobe 4 mm broad, the lateral lobes 3 mm broad, all apically rounded; stamens exserted ca. 2 mm below tips of the lips, anther cells superposed, basally acute, ca. 2 mm long, connective ca. 1 mm long, the filaments glabrous. Fruits clavate, capsules 13–15 mm long, 4 mm broad, 3 mm thick, glabrous, seeds light brown, suborbicular, ca. 3 mm in diameter, glabrous.

Found in rain forests of Costa Rica and Panama from sea level to about 1100 m elevation. In Costa Rica numerous collections have been made, but all are from the vicinity of San Ramón in Alajuela Province. Flowering collections have been made in Costa Rica in February and March.

*Justicia urophylla* is recognized by its dense, terminal spikes with short, inconspicuous bracts (4 to 6 mm long), its white corollas (more than 3 cm long), and its equally five-parted calyx with short segments (2 to 3 mm long). It may be confused

with *J. secunda*, which is found in adjacent regions of Panama, but has not been collected in Costa Rica. It can be distinguished from *J. secunda* by its dense spikes (vs. a looser, paniculate to thyrsoid inflorescence), white corollas (vs. red or purplish red), and its leaves with basally attenuate laminae (vs. acute or obtuse).

**Justicia valerii** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1236. 1938. Figure 11.

Decumbent herb to 30 cm tall, stems subquadangular to near terete in older portions; internodes between leaf-bearing nodes 1.5–7 cm long, ca. 1 mm thick, puberulence retrorse. Leaves petiolate, petioles short, to 5 mm long, puberulence retrorse to pilose; laminae elliptic-ovate, 3.5–10 (13) cm long, 1.5–4 (5) cm broad, margins entire to crenulate, apically acuminate, basally attenuate, cystoliths dense and prominent on both surfaces, glabrous. Inflorescences in terminal and axillary spikes to 7 cm long, ca. 1 cm broad excluding corollas; bracts imbricate, ovate-elliptic, 6–10 mm long, 4–6 mm broad, apically obtuse to rounded apiculate, basally obtuse to rounded, strigose hairs mostly restricted to midrib, veins very prominent, forming a coarse reticulation, ciliolate; bracteoles lanceolate, 7–8 mm long, 1.25–1.5 mm broad, apically acute to acuminate, apiculate, basally acute, veins very prominent, pubescence that of the bracts, ciliolate, peduncles 1–3 cm long, puberulence retrorse. Flowers with a 5-merous calyx, posterior segment setaceous, ca. 2 mm long, other segments subulate, 5.5–6.5 mm long, 0.5–0.75 mm broad at base, glandular-puberulous, corollas white or bluish white, 9–11 mm long, 2 mm broad at base expanding to 3.5 mm broad at the mouth, sparingly puberulous, upper lip ca. 4.5 mm long, 2.5 mm broad at base, apically acute, lower lip 5 mm long, 3-lobed, lobes 2.5 mm long, middle lobe 2.5 mm broad, lateral lobes 2 mm broad, all apically rounded; stamens exserted ca. 1 mm beyond the mouth, anther cells superposed, upper cell ca. 0.75 mm long, lower cell ca. 0.5 mm long, both cells basally rounded. Fruits clavate, 7–8 mm long, 2 mm broad, 1.5 mm thick, puberulous; seeds reddish brown, flattened, suborbicular, ca. 1.25 mm in diameter, papillate.

Found in pastures, along trails, and in clearings of premontane moist to premontane rain forest from 750 to 2000 m elevation in both the Caribbean and Pacific watersheds of the Cordilleras Tilarán, Central, and Talamanca. Flowering collections have been made from December through March.

*Justicia valerii* is recognized by its stems with short retrorse hairs, spikes with imbricate bracts which are ovate-elliptic with a coarse reticulation pattern, and unequal calyx segments. It is easily confused with *J. candelariae* and differs from it in its stems with short retrorse hairs (vs. pilose stems),

longer laminae (3.5 to 10 cm vs. 2.5 to 6.5 cm), and glandular-puberulous calyx (vs. ciliolate).

### Louteridium S. Watson

REFERENCE—A. Richardson, Revision of *Louteridium* (Acanthaceae). Tulane Studies in Zoology and Botany 17: 63–76. 1972.

**Shrubs** or soft-wooded **trees**, at least some species deciduous. **Leaves** petiolate, laminae ovate, elliptic, ob lanceolate or obovate with entire or crenate margins, cystoliths present and usually prominent in dried specimens. **Inflorescences** in terminal, cymose, bracteate panicles, with a pair of cymes at each node, **bracts** and bracteoles small. **Flowers** with a 3-merous calyx, corollas large, red, light green or yellow, the tube expanding abruptly just above the ovary, bilabiate, 2 lobes above, 3 lobes below, throat prominently gibbous; stamens 2 or 4, exserted from an arched position in the bud, anthers 2-celled, cells equal. **Fruits** a sessile capsule with 2 carpels; retinacula present, seeds numerous.

This is a genus of the New World tropics, with nine woody species found in Mexico through Panama. Collections of *L. costaricense* have been made in Darién Province of Panama. This province is adjacent to Colombia, and it is likely to be found in that country as well.

*Louteridium* is not easily confused with other genera of the Acanthaceae since it is the only genus with a large, three-merous calyx. This, plus the large flowers and sessile, many-seeded capsules, makes it relatively easy to identify.

**Louteridium costaricense** Radlk. & Donnell Smith, Bot. Gaz. (Crawfordsville) 37: 422. 1904. Figure 12.

**Shrubs** to 1.5 m tall; stems tetragonal, internodes between leaf-bearing nodes 1.5–10 cm long, 3–4.5 mm thick, glabrous. **Leaves** with petioles to 5 cm long, glabrous; laminae elliptic, 21–32 cm long, 9.5–15 cm broad, apically acuminate, basally attenuate, margins entire, both surfaces glabrous, cystoliths dense and prominent on both surfaces. **Inflorescences** in narrow terminal panicles, peduncles to ca. 15 cm long, pedicels 1.5–3 cm long, glabrous, **bracts** and bracteoles ovate-lanceolate, 8–12 mm long, 3–5 mm broad, glabrous. **Flowers** with 3-merous calyx, segments loosely enclosing the bud, chartaceous, narrowly elliptic, apically acute, subequal, 2–4.5 cm long, 1–2 cm broad, cystoliths numerous, venation conspicuous; **corolla** pale green or yellow, 3.5 cm long, glabrous, lobes apically rounded, 8–9 mm long, 6–7 mm broad, throat prominently gibbous; **stamens** 2, exserted, anthers ca. 10 mm long. **Fruit** clavate, 3–3.5 cm long, 7 mm broad, 7 mm thick, glabrous.

In Costa Rica this species occurs in moist forests from 500 to 1000 m elevation. It is found in habitats such as on rotted logs or humus-covered rocks in streams and along weedy, shaded roadsides. It is known from Vueltas (Las Vueltas), Alajuela Province, near Siquirres in Limón Province and San Vito of Puntarenas Province. Numerous collections have been made in lowland rain forests of most provinces in Panama. Flowering collections were made in March and August.

*Louteridium costaricense* is recognized by its large three-merous calyx with narrowly elliptic segments and its large, showy corolla with two stamens. It is most similar to *L. tamaulipense* of Mexico, but differs from it in its persistent bracts (vs. caducous) and glabrous inflorescence (vs. glandular-puberulous).

### Megaskepasma Lindau

**Shrub.** **Leaves** petiolate; laminae large, elliptic, cystoliths lacking. **Inflorescences** in loose terminal spikes, the **bracts** and bractlets large and conspicuously colored. **Flowers** with 5-merous calyx of equal segments; corolla bilabiate, the upper lip bifid, the lower lip 3-lobed; **stamens** 2, the anthers 2-celled; stigma subcapitate. **Fruit** a clavate capsule, 4-seeded, the seeds borne on hooklike funicles.

This is a monotypic genus and is endemic to the Neotropics. It is recognized by its large, showy bracts and its large leaves, which when dried, are shown to lack cystoliths.

**Megaskepasma erythrochlamys** Lindau, Bull. Herb. Boissier 5: 666. 1897. Figure 13.

**Shrub** to 4 m tall; stems subquadangular, internodes between leaf-bearing nodes 2.5–4 cm long, 6–8 mm thick, puberulous. **Leaves** with petioles to 4 cm long, petioles puberulous; laminae elliptic, 13–28 cm long, 3.5–13 cm broad, apically acuminate with a rounded, apiculate tip, basally acute, margins entire to crenulate, sparingly striate on the costa and lateral veins of both surfaces, cystoliths none. **Inflorescences** in lax, clustered spikes to 20 cm long, 4 cm broad excluding corollas, peduncle to 3.5 cm long, brown puberulous, rachis terete, brown puberulous, **bracts** deep reddish purple drying to reddish brown, solitary, ovate to elliptic, 3.5–4.7 cm long, 1.5–2 cm broad, apically acute, basally acute, sparingly strigulose on both surfaces, mostly restricted to the costa, margins entire; bracteoles elliptic to 20 mm long, 5 mm broad, apically acute, basally attenuate, sparingly strigulose. **Flowers** with 5-merous calyx, calyx segments equal, lanceolate, ca. 10 mm long, 2 mm broad basally, densely striate; **corolla** white, tube cylindrical, 20–25 mm long, 2–3 mm broad basally, pilosulous, the upper lip lanceo-

late to 35 mm long, 5 mm broad basally, apically 2-lobed, the lobes subulate, 1.5 mm long, 0.5 mm broad basally, the lower lip elliptic, 35 mm long, 8 mm broad, pilosulous outside, apically 3-lobed, the lobes lanceolate, 7 mm long, 2 mm broad basally; **stamens** exerted ca. 3 cm beyond throat of the corolla, the filaments glabrous, the anthers 4.5 mm long, 1.5 mm broad, basally mucronate; ovary 2 mm long, glabrous. **Fruits** clavate, 30–35 mm long, 8–10 mm broad, 6–7 mm thick, apically attenuate and mucronate, glabrous; seeds 4, suborbicular, flattened, ca. 7 mm in diameter, glabrous.

A native of Venezuela, this plant is cultivated throughout much of the Neotropics.

*Megaskepasma erythrochlamys* is recognized by its shrubby habit, its large leaves which lack cystoliths, and its flowers with large (3.5–4.7 cm long) reddish purple bracts, and its large (50–60 mm long) white, bilabiate corollas with two exserted stamens having two-celled anthers with equal cells. It most closely resembles the genus *Justicia*, but differs in its leaves, which lack cystoliths, and its much larger bracts.

### **Mendoncia** Vell.

Tall, suffrutescent vines. Leaves opposite, petiolate, laminae pinnately veined, margins mostly entire, cys-

toliths lacking. **Flowers** axillary, 1 to several or occasionally many in each axil, each flower pedicellate and subtended by 2 flat or keeled **bracts**, connate prior to anthesis and variably so at anthesis; calyx reduced to an annular, often membranous structure, usually glabrous; **corolla** 5-merous, the tube funnelform or tubular, usually expanded at the base, the lobes equal or nearly so, reflexed or spreading, the throat often oblique; **stamens** 4, didynamous, the filaments short, the anthers linear-lanceolate, 2-celled, usually flattened, apically acute, glandular-puberulous, basally lobed, the lobes more or less unequal; ovary oblique. **Fruit** a compressed drupe, often apically oblique, the endocarp pulpy; seeds 1 or 2.

This is a genus of approximately 60 species from Central and tropical South America, tropical Africa, and Madagascar. In *Mendoncia gracilis*, *M. lindavii*, and *M. littoralis* (of Colombia and Panama), the bracts are completely joined before anthesis, enclosing the flower in a clear, colorless liquid until it opens. While this has not been reported for other species of *Mendoncia*, the connate habit of the bracts before anthesis suggests that other species may have fluid-enclosed flowers as well.

*Mendoncia* is recognized by its viny habit, its paired, connate bracts partially enclosing five-merous flowers with four didynamous stamens, and its drupaceous fruits.

### Key to Species of *Mendoncia*

- 1a. Corolla 1.5 cm long; flowers in axillary umbels ..... *M. brenesii*
- 1b. Corolla 2.5 cm long or more; flowers axillary, borne singly or in 2's or 3's ..... 2a
- 2a. Young stems narrowly winged; hairs on upper leaf surface not arising from stellate bases ..... *M. retusa*
- 2b. Young stems not winged; hairs on upper leaf surface arising from stellate bases ..... 3a
- 3a. Corollas less than 3.5 cm long; bracts less than 2 cm long ..... 4a
- 3b. Corollas more than 3.5 cm long; bracts more than 2.5 cm long ..... 5a
  - 4a. Petioles 2–4 cm long; bracts obovate to elliptic and basally subcordate ..... *M. costaricana*
  - 4b. Petioles 1–2 cm long; bracts elliptic to ovate and basally rounded ..... *M. gracilis*
- 5a. Bracts oblong-lanceolate; widest below the middle; hairs on stem evenly distributed, somewhat appressed ..... *M. landavii*
- 5b. Bracts oblong to oblong-elliptic; widest at the middle; hairs on stem mostly at the angles and spreading ..... *M. tonduzii*

**Mendoncia brenesii** Standley & Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18(4): 1239. 1938. Figure 12.

Suffrutescent vine; stems scandent, subquadrangular, grooved; **internodes** between leaf-bearing nodes 4.5–12 cm long, 1.5–3 mm thick, glabrous to sparingly and minutely strigose. Leaves with petioles to 2.6 cm long, pet-

ioles sparingly strigose; laminae ovate-elliptic, 6–11.5 cm long, 3–7.5 cm broad, apically acuminate with a mucro 1–2 mm long, basally rounded, margins entire, glabrous above and below except for sparingly minutely strigose on the costa. **Inflorescences** in axillary umbels of 5–10 flowers radiating from short, flat, rounded, axillary spurs, pedicels ca. 1 cm long, sparingly strigose; bracts ovate, 8–12 mm long, 5–7 mm broad, apically

acute, basally rounded, sparingly strigose, bracts frequently fused to ca.  $\frac{1}{2}$  their length. Flowers with a membranous calyx; corolla white, ca. 15 mm long, glabrous, the tube ca. 8 mm long, 3 mm broad, slightly expanded basally, the lobes obovate, ca. 7 mm broad; stamens included, the anthers 3 mm long, apically calcarate, basally obtuse.

Few collections of this species have been made, but these have been in shady areas of cloud forests of the Cordillera Central, Alajuela Province, at elevations of 1000 to 1500 m. It has also been collected in adjacent Panama at 1500 to 2000 m. Flowering collections have been made from June through August.

*Mendoncia brenesii* is most easily recognized by its axillary umbels of small, white flowers. It is not easily confused with other *Mendoncia* species if its axillary umbels are present.

***Mendoncia costaricana* Oerst.**, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 113. 1855. Figure 12.

Herbaceous vine; stems subquadrangular, grooved; internodes between leaf-bearing nodes 5.5–14 cm long, 1.5–2.5 mm thick, strigose. Leaves with petioles to 3.8 cm long, petioles strigose; laminae elliptic to elliptic-ovate, 7.7–13.5 cm long, 3–6.7 cm broad, apically abruptly acuminate and sometimes falcate, the apiculate tip to ca. 2 mm long, basally acute to near rounded, margins entire, sparingly scabrous above with hairs arising from stellate bases, sparingly strigose beneath. Flowers axillary, borne singly or in 2's or 3's, pedicels ca. 2 mm long, strigose; bracts obovate to elliptic, 15–18 mm long, 8–10 mm broad, apically obtuse and apiculate, basally subcordate, strigose outside, glabrous within; corollas white with dark spots at the throat, to 3 cm long, 8 mm broad at the throat, 4–5 mm broad, ovary glabrous. Fruit flattened, ovoid with double margins, ca. 20 mm long, 13 mm broad, 4 mm thick, puberulous.

The seven collections of this species in Costa Rica indicate that it is wide ranging in rain forests at elevations of 500 to 1000 m in the Pacific watershed area of San José Province and the Cordillera Central portions of Alajuela, Cartago, and Puntarenas provinces. It is also found in adjacent Chiriquí Province of Panama. Flowering collections have been made in July, August, and September.

*Mendoncia costaricana* is recognized by its comparatively short (3 cm long), white corollas borne singly or in pairs of axillary flowers, its strigose stems, and its relatively long petioles (2 to 4 cm long). It may be confused with *M. gracilis*, but can be distinguished from it by its longer petioles

(2 to 4 cm long vs. 1 to 2 cm) and its obovate to elliptic bracts, which are basally subcordate.

***Mendoncia gracilis* Turrill**, Bull. Misc. Inform. 418. 1919.

Suffrutescent vine; young stems quadrangular, strigose to sericeous, hairs appressed upward; internodes between leaf-bearing nodes, 4.5–10.5 cm long, 1.2–2.5 mm thick. Leaves with strigose to sericeous petioles to 2 cm long, mostly ca. 1.5 cm long; laminae elliptic to elliptic ovate, 8.5–12.5 cm long, 4–7 cm broad, apically acuminate, often with a mucro to 2 mm long, basally rounded to obtuse, margins entire, the veins prominent, usually 4 pairs, sparingly strigose above, hairs emerging from stellate bases, strigose below. Inflorescences axillary, the pedicels borne singly to 3 or 4, 1.2–1.5 cm long, strigose to sericeous; bracts elliptic to ovate, entire, 15–19 mm long, 6–9 mm broad, apiculate, basally rounded, strigose to sericeous outside. Flowers with the calyx reduced to an entire membranous cup ca. 1 mm deep, glabrous; corolla white, funnelform, ca. 3 cm long, basally 3 mm broad expanding to 6 mm broad at the throat, the throat streaked with reddish brown, oblique, the lobes 5–6 mm long, 4–5 mm broad, shallowly emarginate, the tube glandular puberulous inside below the stamens, remainder of corolla glabrous; stamens included. Fruits ovoid, ca. 1.7 cm long, purple-black and fleshy at maturity.

This species, originally described from along trails and openings in the rain forests of the Pacific slope and intermountain areas of Colombia, has also been collected in similar habitats in central Panama. One collection, Durkee 83-4 (F, GRI), has been made in the Golfo Dulce area, Puntarenas Province of Costa Rica, in mature rain forest along the new road to Jiménez from the Interamerican Highway near the Río Olla. The flowering collection was made in January.

*Mendoncia gracilis* can be recognized by its white corollas about 3 cm long borne singly to three or four in leaf axils, elliptic bracts (15 to 19 mm long), basally rounded with upwardly appressed sericeous hairs; young stems and leaves also have upwardly appressed hairs, and petioles are 1 to 2 cm long. It may be confused with *M. costaricana*, which differs in its longer petioles (2 to 4 cm long) and its obovate to elliptic bracts, which are basally subcordate.

***Mendoncia lindavii* Rusby**, Mem. Torrey Bot. Club 4: 241. 1895. Figure 12.

Suffrutescent vine; younger stems quadrangular; internodes between leaf-bearing nodes, 3.5–17 cm long, 1.5–3 mm thick, wooly hairs rust-colored. Leaves petiolate, petioles to 3 cm long, wooly with rust-colored hairs; laminae elliptic, 5.8–11.5 cm long, 3.3–6.4 cm

broad, apically acuminate, basally obtuse to rounded, margins entire, sericeous above with hairs rising from stellate bases, sericeous beneath, but hairs more dense and prostrate. **Flowers** axillary, pedicellate, borne singly or in pairs, pedicels to 3 cm long, pubescence that of the petiole; mature bracts oblong-lanceolate, subfalcate, 3.2–4 cm long, 0.8–1.2 cm broad, apically attenuate, basally rounded, woolly with rust-colored hairs; **corolla** red, pink, or white, funnelform, 4–5 cm long, 6 mm broad basally expanding to 8 mm broad at the throat, glabrous, the 5 equal lobes to 6 mm long, 4.5 mm broad, apically retuse to rounded; **stamens** attached at about the mid-point of the corolla tube, anthers 10–13 mm long, 1.5 mm broad, filaments 2 mm long; ovary velutinous, ca. 4 mm long, 2.5 mm broad, style to 5 cm long, stigma forked. **Fruits** flattened, obovate, to 20 mm long, 11 mm broad, 8 mm thick, apically oblique and terminated by a portion of the persistent style, dark brown (dull purple when fresh) and densely puberulous.

Ranging from Belize and Guatemala to Bolivia, this species has been collected in rain forest areas of Costa Rica at elevations of 500 to 1000 m on the Pacific Watershed only in Puntarenas Province near Panama and San José Province in the vicinity of General Viejo (El General). Flowering collections have been made in June and January.

*Mendoncia lindavii* is recognized by its large red, pink, or white corollas (4 to 5 cm long), its large (3.2 to 4 cm long), oblong-lanceolate, subfalcate bracts with conspicuous, reddish brown wooly hairs, and its large (to 20 mm long) dark brown or purplish, obovate fruits. It may be confused with *M. retusa*, which also has large flowers, but can be distinguished from it by its wooly stems (vs. strigose), its nonwinged stems (vs. narrowly winged), and its wooly, oblong-lanceolate bracts (vs. mostly glabrous, oblong).

***Mendoncia retusa* Turrill, Bull. Misc. Inform. 423. 1919. Figure 12.**

Suffrutescent vines with narrowly winged, quadrangular stems; internodes between leaf-bearing nodes 4–14 cm long, 1–2.5 mm thick, sparsely strigose to glabrous. Leaves petiolate, petioles to 5.2 cm long, sparsely strigose to puberulous; laminae elliptic, 7–15 cm long, 2.5–7.5 cm broad, apically acuminate and mucronulate, basally acute, obtuse or rounded, margins undulate, sparsely strigose on costa beneath. Flowers axillary, pedicellate, borne singly, pedicels 1.75–3 cm long, sparingly strigose to glabrous; bracts green, elliptic to elliptic-oblong, 1.5–3.0 cm long, 1–2 cm broad, apically retuse or rounded, mucronate, basally rounded, mostly glabrous; corolla white with a purplish throat, 4–5 cm long, glabrous, lobes equal, 5–6 mm long, apically obtuse. Fruit irregularly obovate to 19 mm long, 9 mm broad, 8 mm thick, puberulous.

Found in lowland rain forests ranging from

Mexico (Chiapas) through Panama, this species is one of the most commonly found in Central America, although, again, few collections have been made in Costa Rica. However, these collections are from both the Caribbean and Pacific areas at elevations of 15 to 100 m. Flowering collections have been made in June and October.

*Mendoncia retusa* is recognized by its narrowly winged, quadrangular stems, its large (4–5 cm long), white corollas with purplish throats, and its elliptic to elliptic-oblong bracts, which are apically retuse or rounded and mucronate. The bracts are somewhat variable, and in those specimens with more oblong bracts, there may be confusion with *M. lindavii*, which differs in its rust-colored, wooly hairs, its lack of winged stems, and its red, pink, or white corollas.

***Mendoncia tonduzii* Turrill, Bull. Misc. Inform. 413. 1919. Figure 12.**

Suffrutescent vines with quadrangular stems; internodes between leaf-bearing nodes 9–12 cm long, 2–3 mm thick, densely pilose, hairs tawny and mostly restricted to the angles. Leaves petiolate, petioles to 2 cm long, densely pilose tawny hairs; laminae elliptic to elliptic-ovate, 7–13 cm long, 5–8.3 cm broad, apically acuminate, often with an apicule to 2 mm long, basally acute to rounded, margins entire, pilose hairs with stellate bases above, more densely pilose below. Flowers solitary or in pairs in the axils of the upper leaves, pedicellate, pedicels 2–4 cm long, pilose; bracts oblong to oblong-elliptic; ca. 4 cm long, 1.5 cm broad, apically rounded and mucronate, basally rounded, densely pilose, hairs tawny; corolla white, ca. 5 cm long, 8 mm broad at the oblique throat, the lobes equal, emarginate, spreading, ca. 8 mm long, 5–6 mm broad, glabrous. Fruit purplish black at maturity, ca. 2 cm long, 1 cm broad, 6 mm thick, densely puberulous.

This uncommon species has been collected in forests at 500 to 1000 m elevation of the Tilarán area, Guanacaste Province, *Brenes 12675* (F), and Tucurrique, Cartago Province, *Tonduz 12946* (US, holotype). Three collections have also been made in similar habitats in Coclé and Colón provinces of Panama.

*Mendoncia tonduzii* is recognized by its dense, tawny pilose hairs, its oblong to oblong-ovate bracts, 4 cm long, apically rounded and mucronate, and laminae with pilose hairs on stellate bases. This distinguishes it from the more common *M. lindavii*, which it most closely resembles.

***Nelsonia R. Br.***

Herbs, stems softly villous. Leaves sessile; laminae with entire margins. Inflorescences of dense, terminal

and axillary spikes; **bracts** imbricate, 1 per flower. **Flowers** with 4-merous **calyx**; **corolla** bilabiate; **stamens** 2, anthers 2-celled, the cells parallel, each cell globose; stigma 2-lobed. **Fruits** a 2-chambered capsule, capsules oblong; seeds borne on papilliform funicles.

There is only one species described for this genus, which was first collected in Java. The genus was named for David Nelson, a gardner who accompanied Cook on his last voyage.

**Nelsonia canescens** (Lam.) Spreng., Syst. veg. ed. 16. 1: 42. 1825. Figure 13.

**Herbs**, decumbent to ascending with narrow, branching stems to 40 cm long; **internodes** between leaf-bearing nodes 1–5 cm long, 1–2 mm thick, villous to woolly. **Leaves** sessile; **laminae** ovate, 1–8 cm long, 0.5–3 cm broad, apically acute to obtuse, basally acute to obtuse, margins entire, cystoliths lacking, villous above and beneath. **Inflorescences** in dense spikes to 6.5 cm long, 5.5 mm broad excluding corollas, pedunculate or sessile, mostly axillary, flowers sessile to pedicels ca. 1 mm long; **bracts** imbricate, 1 per flower, ovate, 4–6 mm long, 4–5 mm broad, apically acuminate, velutinous. **Flowers** with 4-merous **calyx**, segments ca. 4 mm long, unequal, posterior segment ovate, 2.5 mm broad, anterior segment lanceolate, 1.5 mm broad, lateral segments lanceolate, 1 mm broad; **corolla** deep purple to blue, bilabiate, the tube ca. 3 mm long, upper lip 2-lobed, ca. 1 mm long, lower lip 3-lobed ca. 1 mm long. **Fruit** sessile, ca. 5 mm long, ca. 10 seeds per locule.

Found in disturbed habitats, especially in moist, sandy areas along roadsides, trails, and streambeds, this species occurs in Mexico, Central America, northern South America, tropical Africa, India to Indo-China, Malay Peninsula, and Australia. Collected in Costa Rica at elevations of 150 to 1500 m in Alejuela, Guanacaste, and San José provinces. Flowering collections have been made in February through May.

*Nelsonia canescens* is recognized by its decumbent stems with numerous, compact spikes, velutinous, imbricate bracts subtending minute flowers with bilabiate bluish corollas, and two stamens with two equal-celled anthers. Its capsules are sessile, and its seeds lack the hooklike funicles which serve to eject the seeds of most Acanthaceae. Certain specimens may resemble *Elytraria imbricata*, which has larger leaves (6 to 20 cm vs. 1 to 8 cm long) and stiff, awned bracts (vs. soft, awnless bracts).

#### **Odontonema** Nees

REFERENCE—V. M. Baum and J. L. Reveal, A new proposal to conserve 8037 *Odontonema* (Acanthaceae). *Taxon* 31: 757–759. 1982.

**Herbs or shrubs.** Leaves sessile to petiolate; **laminae** often large with cystoliths visible on both surfaces of dried specimens. **Inflorescences** in terminal panicles, thyrses, or verticillate inflorescences, **bracts** inconspicuous. **Flowers** with 5-merous, equally segmented **calyx**; **corolla** bilabiate, the upper lip 2-lobed, the lower lip 3-lobed; **stamens** 2, exserted or extending to the mouth, the anthers 2-celled with the cells parallel and basally blunt, staminodes 2. **Fruits** in clavate capsules, seeds 4 on hooklike funicles.

This is a genus of 29 species, all endemic to the Neotropics.

**Odontonema tubiforme** (Bertol.) Kuntze, Revis. gen. pl. 2: 493. 1891. *Justicia tubiformis* Bertol., Novi Comment. Acad. Sci. Inst. Bononiensis 4: 405. 1840. *Thrysacanthus flagellum* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 146. 1855. *Odontonema flagellum* (Oerst.) Kuntze, Revis. gen. pl. 2: 494. 1891. *Thrysacanthus strictus* Nees in DC., Prodr. 11: 324. 1947. *Odontonema strictum* (Nees) Kuntze, Revis. gen. pl. 2: 494. 1891. Figure 13.

Suffrutescent herbs to shrubs 2.5 m tall; **internodes** between leaf-bearing nodes 1.5–9 cm long, 1.5–3.25 mm thick, puberulous. **Leaves** sessile to petiolate, petioles to 3 cm long, puberulous to subglabrous; **laminae** elliptic to broadly elliptic-ovate, 11–36 cm long, 3.5–11 cm broad, apically acuminate, basally attenuate, margins crenate to entire (often on the same plant), cystoliths more visible on upper surface, obscure beneath, glabrous. **Inflorescences** verticillate to 35 cm long, 1.5 cm broad excluding corollas or fruits, peduncles 1.5–7 cm long, puberulous, rachis puberulous to tomentose, flowers pedicellate with 1 to 10 pedicels per cluster, pedicels puberulous; **bracts** and bracteoles inconspicuous, subulate, 3–10 mm long, 1–2 mm broad, puberulous. **Flowers** with 5-merous **calyx**, calyx lobes equal, subulate, 2–4 mm long, 0.6–1 mm broad, minutely puberulous; **corolla** pink or red, funnelform, 15–30 mm long, 4–5.5 mm broad at the throat, 1–3 mm broad at the base, glabrous, upper lip 7–8 mm long, 4.5–5 mm broad, bilobed, lobes apically acute, 3.5–4 mm long, lower lip 7–8 mm broad, lobes elliptic, apically rounded, 3–4 mm broad, all lobes with glandular hairs inside; **stamens** exserted, anthers ca. 2.5 mm long, filaments glabrous, staminodes 1–3.5 mm long. **Fruits** clavate, 2–3 cm long, 4 mm broad, 3–4 mm thick, glabrous, seeds 4, ovate with an oblique base, flattened, 5–6 mm long, 3.5–4.5 mm broad, 1 mm thick, surface densely rugose.

This species is found in light gaps, clearings, and along streams and trails in rain forests of lower elevations to rain forest transition at higher elevations of Mexico, Central America, and Panama. In Costa Rica it has been collected in both the Atlantic and Pacific watersheds from all provinces except Guanacaste at elevations of 50 to 1200 m.

Flowering collections have been made in July and October through April. This is a wide-ranging species which is subject to much variation in leaf, flower, and fruit size, as well as pubescence of the rachis and number of flowers per cymule. Many of the early species were erected on these bases, but additional collections show intergradation in all of these characters. The only character that appears unique to *Odontonema flagellum* (Oerst.) Kuntze is the narrowed, flagellate tip of the inflorescence which I believe is an early flowering stage of *O. tubiforme*.

*Odontonema tubiforme* is recognized by its verticillate inflorescences with near-equal, funnel-form corollas that are pink or red with two exserted stamens with two-celled anthers and two short staminodes. It is most frequently confused with *Razisea* species, but can be distinguished from them by its staminodes, two-celled anthers, and more broadly funnelform corollas.

### Poikilacanthus Lindau

**Herbs or shrubs.** Leaves of a pair unequal, petiolate. Flowers borne in small terminal or axillary, bracted spikes or heads. Flowers with 5-merous calyx; corolla narrow, bilabiate; stamens 2, anthers 2-celled, the cells unequally attached, the cells rounded or ending in a short spur; pollen elliptic, poroporous. Fruits a clavate, 2-chambered capsule with 4 seeds, each borne on hooklike retinacula.

This is a Neotropical genus of about 12 species found in Central America and tropical South America. It is similar to the genus *Justicia*, but differs from it in its unequal leaf pairs and its pollen morphology.

### Poikilacanthus macranthus Lindau, Bull. Herb. Boissier 3: 481. 1895. Figure 13.

Shrubs to 3 m tall; internodes between leaf-bearing nodes 2–6.5 cm long, 1–2.25 mm thick, quadrangular, puberulence of appressed hairs varying from a few hairs restricted to the angles to dense. Leaves of a pair unequal, petioles 0.5–2.6 cm long, pubescence that of the stem; laminae ovate to ovate-elliptic, 3–7 (8.5) cm long 1.5–3.5 (4) cm broad, apically acuminate, basally obtuse to rounded and often oblique, margins entire, appressed hairs restricted to costa and veins on both surfaces to pilose, cystoliths dense and prominent on both surfaces. Inflorescences in terminal, sessile, headlike clusters of 2–4 flowers; bracts oblong to spatulate, 6–9 mm long, 1.5–3 mm broad, ciliate, bracteoles similar, but smaller. Flowers with 5-merous calyx, calyx segments equal,

subulate, 7–9 mm long, 1.3–1.5 mm broad, ciliolate toward apex; corolla lavender or purplish, very narrowly funnelform, 6.5–7.8 cm long, 4–5 mm broad at the throat, 1.5 mm broad basally, glandular-puberulous, upper lip 30–35 mm long, 7–9 mm broad, apically minutely 2-lobed, lower lip 22–27 mm long, 9–12 mm broad at ca. midpoint, apically 3-lobed, lobes ca. 2 mm long, 3 mm broad; stamens exserted to ca. the tip of the upper lip or just beyond, anther cells ca. 2.25 mm long, lobes obtuse. Fruits clavate, 12–15 mm long, 3.5–5 mm broad, 3.1–3.5 mm thick, sparingly puberulous.

Found in gaps or clearings, along trails and streams in cloud forest areas of Mexico (Chiapas), Honduras, Guatemala, Nicaragua, and Costa Rica. Collected in Costa Rica in cloud forest areas of the Cordilleras Tilarán, Central, and Talamanca at elevations of 1000 to 1750 m, mostly on the Pacific watershed, but occasionally on the Caribbean as well. Flowering collections have been made in February, March, and September through November.

*Poikilacanthus macranthus* is recognized by its unequal leaf pairs, its lavender, narrowly funnel-form bilabiate corolla (6.5 to 7.8 cm long), two exserted stamens with widely superposed anther cells, and elliptic, poroporous pollen. It is most easily confused with species of *Justicia*, but can usually be distinguished from these in its unequal leaf pairs (excluding *Justicia trichotoma*), its large, narrowly funnelform corollas, and its poroporous pollen (vs. two-, rarely three-, or four-, porate).

### Pseuderanthemum Radlk.

**Herbs or small shrubs.** Leaves commonly petiolate; laminae elliptic, ovate, or lanceolate, cystoliths generally visible on both surfaces of dried specimens. Inflorescences in terminal or axillary racemes, spikes or panicles; 1 bract and 2 bracteoles subtending each flower or flower cluster, bracts and bracteoles inconspicuous. Flowers with 4 or 5 subulate calyx segments; corolla white, blue, purplish or pink, salverform, the tube narrow, the limb spreading, the 5 lobes subequal; stamens 2, included or exserted, inserted at or above the middle of the corolla tube; anther 2-celled, the cells basally obtuse or acute; staminodes 2, minute. Fruits in clavate capsules, seeds 2 or 4 on hooklike retinacula.

This is a genus of about 120 species from the New and Old World tropics. The flowers of this genus resemble those of the genus *Chamaeranthemum* which differs in its four stamens that are included, with the posterior pair either one-celled or sterile.

## Key to Species of *Pseuderanthemum*

- 1a. Inflorescence a cymose panicle (thyrsse); rachis of inflorescence glabrous ..... *P. atropurpureum*
- 1b. Inflorescence a raceme, spike, or spicate panicle; rachis glandular-puberulous or puberulous .. 2a
- 2a. Petioles conspicuously winged, laminae bases long-attenuate; stamens exserted ... *P. cuspidatum*
- 2b. Petioles not winged, laminae bases acute or attenuate, but not long-attenuate; stamens included .... 3a
- 3a. Flowers in opposite fascicles of 2–3 or more; laminae mostly more than 9 cm long .... *P. pittieri*
- 3b. Flowers borne singly and opposite, or if in pairs, alternate; laminae mostly less than 9 cm long .... 4a
- 4a. Flowers borne singly and opposite; capsules 16–19 mm long, puberulous ..... *P. praecox*
- 4b. Flowers borne singly or in pairs, mostly alternate; capsules 11–15 mm long, glabrous .... *P. standleyi*

**Pseuderanthemum atropurpureum** (Bull) Bailey,  
Gentes Herb. 1: 130. 1923. *Eranthemum atropurpureum* Bull. Gard. Chron. 1: 619. 1875. Figure 13.

**Shrubs** or small trees to 4 m tall; **internodes** between leaf-bearing nodes 2.5–5 cm long, 2–4 mm thick, tetragonal, glabrous. **Leaves** petiolate, petioles 0.5–1.8 cm long, glabrous except for a tuft of hair at the stipular ring; laminae elliptic to ovate, 4.5–14.5 cm long, 4.5–6.5 cm broad, apically acute, some apiculate, basally attenuate, margins entire, greenish beneath and dark purple above, glabrous on both surfaces, cystoliths dense and near punctiform on both surfaces. **Inflorescences** in terminal and axillary cymose panicles with the flowers in subsessile fascicles of mostly 3 flowers; pedicels, peduncles and rachises glabrous, pedicels to 5 mm long, peduncles to 7 cm long, rachises to 13 cm long, **bracts** elongate, lower bracts ca. 5–7 mm long, 2–3 mm broad, upper bracts progressively smaller, all ciliolate. **Flowers** with 5-merous calyx, the lobes equal, subulate, 2–3 mm long, 0.75–1 mm broad, puberulous; corolla white with magenta spots in the throat, the tube cylindrical, 10–12 mm long, 2–2.5 mm broad basally, the limb 20–22 mm broad, the lobes elliptic, 8–10 mm long, 5–8 mm broad, apically rounded, ciliolate; **stamens** exserted, filaments attached just below the mouth, glabrous anther cells equally attached, ca. 1.5 mm long, basally acute, stamnodes 1.5–2 mm long. **Fruits** not observed.

This species, frequently cultivated in tropical America, is believed to be a native of Polynesia. It sometimes escapes from cultivation. Flowering collections have been made in January and November. *Pseuderanthemum atropurpureum* is recognized by its cymose panicles and purplish leaves, which are frequently variegated with green, white, and pink. These features make it easily distinguishable from other species of the genus.

**Pseuderanthemum cuspidatum** (Nees) Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 13: 286. 1883. *Eranthemum cuspidatum* Nees in Bentham, Pl. hartw. 148. 1839. Figure 13.

**Herbs** to 60 cm tall; **stems** erect; **internodes** between leaf-bearing nodes 1.3–7 cm long, 0.5–3.5 mm thick, quadrangular, puberulous along 2 lines. **Leaves** petiolate, petioles subsessile to ca. 3.5 cm long, glabrous to sparingly puberulous along 2 lines; laminae ovate, 8–19 cm long, 3.2–8.2 cm broad, apically acuminate, basally long-attenuate, margins entire, glabrous to very sparingly scabrous on both surfaces, cystoliths dense and prominent on both surfaces. **Inflorescences** in lax terminal and axillary spikes frequently branched from the base, to 16 cm long, 4 mm broad excluding corollas, the rachis glandular-puberulous; **lowermost bracts** subtending the inflorescence, suborbicular, to 2 cm long, 1.5 cm broad, floral bracts subulate, 2–3 mm long, 0.75–1 mm broad, ciliolate; bracteoles similar, though smaller; **flowers** sessile, paired or in pseudowhorls of up to 5 flowers. Flowers with a 5-merous calyx, calyx lobes equal, subulate, 2.5–3.5 mm long, 0.5–0.75 mm broad, glabrous to sparingly puberulous plus occasional glandular hairs; **corolla** purplish, glabrous, tube cylindrical 1.5–2.8 cm long, 0.8–1 mm broad, lobes of the limb elliptic, 8.5–9 mm long, 4.5–5 mm broad, apically obtuse; **stamens** barely exserted, filament ca. 2.5 mm long, staminodes 0.5 mm long, anther cells 1.25 mm long. **Fruits** clavate, 11–15 mm long, 2–2.5 mm broad, 1.5–2 mm thick, glabrous, seeds 4, ovate, 2.5–3 mm long, 2–2.5 mm broad, rugose.

Found in shady, moist, forested areas from southern Mexico to northwestern South America, this species is wide ranging and not uncommon as suggested by the relatively numerous collections. In Costa Rica it is found in both major watersheds from elevations of about 700 to 1575 m. It has not been collected in Guanacaste, Heredia, or Limón provinces. Flowering collections have been made in May and August through December.

*Pseuderanthemum cuspidatum* is recognized by its often-branched, terminal and axillary spikes with lax flowers in pairs or pseudowhorls, glabrous to subglabrous five-merous calyx, and its long, conspicuously winged petioles (or long-attenuate laminae). It is most easily confused with *P. pittieri*, which differs in its more pronounced glandular-puberulous calyx, its elliptic laminae with more abruptly attenuate bases, and its shorter corolla tubes (7.5 to 11 mm long vs. 15 to 28 mm long) with stamens included.

**Pseuderanthemum pittieri** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1245. 1938. Figure 14.

**Herbs** or small shrubs to 80 cm tall, stems erect; **internodes** between leaf-bearing nodes 1–7 cm long, 2–4 mm thick, subquadangular, puberulous. **Leaves** with short petioles to 6 mm long, glabrous to sparingly puberulous; laminae elliptic, 8.5–19 cm long, 3–8.5 cm broad, apically acuminate, basally attenuate or acute, margins undulate, cystoliths moderately dense and visible on both surfaces, glabrous above, purplish puberulence on costa and main veins beneath. **Inflorescences** in terminal and axillary spikelike racemes, frequently branched; **flowers** opposite, frequently in fascicles of 2–3, pedicels short, ca. 0.5 mm long, puberulous-glandular; **bracts** subulate, 2.5–3 mm long, 1–1.5 broad basally, puberulous plus occasional glandular hairs. Flowers with a 5-merous calyx, **calyx** lobes equal, long-subulate, 3–4 mm long, 0.4–0.5 mm broad basally, glandular-puberulous; **corolla** white, pink, or lavender, the tube subcylindrical, 7.5–11 mm long, 1–1.5 mm broad basally and up to ca. midpoint where the stamens are attached and then expanding to 1.5–2 mm broad at the limb, tube glandular-puberulous, lobes of the limb 10–11 mm long, 4–5 mm broad, apically obtuse; **stamens** included, attached at midpoint of corolla tube, filament ca. 2 mm long, staminodes 0.5 mm long, anther cells 1.25 mm long. **Fruits** clavate, ca. 18 mm long, 2.8 mm broad, 2.2 mm thick, apically acute, puberulous; seeds 4, oval, flattened, ca. 3 mm long, 2.5 mm broad, tubercled.

Found growing in shade of moist lowland forest areas of primary and secondary forests in the Golfo Dulce area and the Osa Peninsula at elevations of 50 to 200 m. Flowering collections have been made in December and January.

*Pseuderanthemum pittieri* is recognized by its comparatively large, elliptic leaves with short-attenuate lamina bases, spikelike racemes, glandular-puberulous calyx lobes and corollas, and short, subcylindric corolla tubes (7.5–11 mm) with included stamens. It is most easily confused with the more widespread *P. cuspidatum*, which differs in its conspicuously winged petioles (long-attenuate laminae), true spikes, glabrous to subglabrous calyx lobes and corollas, and longer cylindric corolla tubes (15–28 mm) with exserted stamens.

**Pseuderanthemum praecox** (Bentham) Leonard, J. Wash. Acad. Sci. 31: 99. 1941. *Eranthemum praecox* Benth., Pl. hartw. 291. 1848. Figure 14.

**Herbs** to 30 cm tall; **internodes** between leaf-bearing nodes 1.8–5 cm long, 1–1.5 mm thick, quadrangular, puberulous mostly along 2 lines. **Leaves** with petioles 4–10 mm long, glabrous to sparingly puberulous; laminae elliptic to elliptic-ovate, 1.5–8 cm long, 0.8–2.5 cm broad, apically acuminate, basally attenuate, margins undulate, cystoliths dense and visible on both surfaces, sparingly strigose above, strigose on costa and main veins below.

**Inflorescences** in short terminal and axillary spikes 1–6.5 cm long, flowers opposite, borne singly, **bracts** subulate, 1.5–3 mm long, 0.5–0.75 mm broad, sparingly puberulous, bracteoles similar though smaller; rachises glandular-puberulous. **Flowers** with a 5-merous calyx, **calyx** lobes long-subulate, 2.5–3.5 mm long at early anthesis, 5–6 mm long in fruit, 0.5–0.75 mm broad, glandular-puberulous to mostly puberulous; **corolla** lavender, pink or bright rose, glabrous outside, the tube cylindrical, 16–19 mm long, ca. 1.5 mm broad, lobes elliptic, 8–12 mm long, 3.5–5 mm broad, apically acute; **stamens** included, filaments 1.75–2 mm long, staminodes ca. 0.5 mm long, anthers 1.5–2 mm long. **Fruits** clavate, 15–18 mm long, ca. 3 mm broad, 4 mm thick, puberulous plus occasional glandular hairs on some; seeds suborbicular, ca. 2 mm in diameter, rugose.

In Costa Rica this species is found in or adjacent to premontane or montane rain forests of the Cordilleras Tilarán and Central at elevations of 1450 to 2000 m, where flowering collections have been made in October, November, February, and April. This species has a range extending to northern and central Mexico.

*Pseuderanthemum praecox* is recognized by its comparatively small, elliptic laminae that are mostly 2 to 6 cm long, its lax spicate inflorescences with flowers opposite and borne singly, and its lavender to bright rose corollas with cylindrical tubes (16 to 19 mm long) and stamens included. It most clearly resembles *P. standleyi*, which differs in its inflorescences with flowers solitary or in pairs mostly alternating on the rachis, slightly shorter corolla tube (ca. 15 mm long vs. 16 to 19 mm long), its staminodes that are slightly longer than the filaments (vs. much shorter), and its shorter, glabrous capsules (10 to 15 mm vs. 15 to 18 mm long and puberulous).

**Pseuderanthemum standleyi** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1246. 1938. Figure 14.

**Herbs** to 1 m tall; **internodes** between leaf-bearing nodes 8–20 mm long, 0.9–1.1 mm thick, puberulous mostly along 2 lines, terete. **Leaves** with petioles 3–6 mm long, puberulous; laminae ovate to lanceolate, 3–8 (9.5) cm long, 1.2–5 cm broad, apically acuminate, basally attenuate, margins entire to undulate, glabrous to pilose above, puberulous beneath, mostly at the costa and veins, the cystoliths dense, moderately prominent on both surfaces. **Inflorescences** in terminal spicate panicles and in axillary spikes, the spikes lax, to 9 cm long, the rachises glandular puberulous; **flowers** solitary or in pairs, mostly alternate; **bracts** and bracteoles subulate, 1.5–3 mm long, ca. 0.5 mm broad basally, puberulous-glandular. Flowers with 5-merous calyx, calyx segments linear-subulate, 5–6 mm long, puberulous-glandular; **corolla** purplish, the tube cylindrical ca. 15 mm long, 1 mm broad, sparingly and minutely puberulous, lobes of

the limb elliptic, ca. 7 mm long, 3.5 mm broad, apically obtuse; **stamens** included, the staminodes slightly longer than the filaments. **Fruits** clavate, 11–15 mm long, 2.5–3 mm broad, 1.5–2 mm thick, glabrous; seeds 4, oblique, ca. 2.5 mm long, 2 mm broad, tuberculate.

Found in moist forests and thickets of the Pacific slopes of the Cordilleras Central and Talamanca, adjacent Panama, and up to west-central Mexico. Flowering collections have been made in December and May.

*Pseuderanthemum standleyi* is recognized by its lax spicate inflorescences with flowers solitary or in pairs, mostly alternate on the rachis, its purplish corolla with a tube about 15 mm long, and its staminodes, which equal or exceed the length of the filaments. It most closely resembles *P. praecox*, which has the flowers borne singly and opposite, longer corollas (16 to 19 mm), much shorter staminodes, and longer, puberulous capsules (15 to 18 mm long vs. glabrous, 10 to 15 mm long).

#### Razisea Oerst.

**Shrubs or herbs** to 2.5 m tall. Leaves petiolate except those subtending the inflorescence which are frequently sessile or subsessile; laminae elliptic to ovate or lanceolate, cystoliths dense and prominent on both surfaces of dried specimens. Inflorescences racemose to thyrsoid, mostly terminal, sometimes branched; flowers sessile or

pedicellate; **bracts** and bracteoles small and inconspicuous. Flowers with 5-merous calyx, **calyx lobes** equal; **corolla** bilabiate, the upper lip narrow, the lower lip broad and shallowly trilobate; **stamens** 2, exserted, the filaments flattened, the anthers 1-celled; style exserted, the stigma 2-parted. **Fruit** a capsule, clavate, 4-seeded.

This is a Central American genus of three species. Two of the species are endemic to Costa Rica, and the third, *R. spicata*, is wide ranging over all of Central America and Panama. *Razisea* is very similar to the genus *Kalbreyeriella* of Panama and Colombia, which differs in its beaked corollas prior to expansion and its calyx lobes which are two to three times longer than the bracts and bracteoles. *Razisea* is also very similar to the genus *Hanstenia*, which differs in its corolla tube, which is usually abruptly expanded above the ovary, and in its paniculate inflorescences. *Razisea* is also difficult to distinguish from the genus *Habracanthus*. The Costa Rican species of *Habracanthus* has a blue corolla, but many of the South American species have corollas of the same color as *Razisea* species (i.e., red or yellow). It is quite possible that a more comprehensive study of these genera will bring them into synonymy.

*Razisea citrina* is known only from two collections, and *R. wilburii*, while relatively abundant where found, is apparently restricted to the Caribbean lowlands of Costa Rica.

#### Key to Species of *Razisea*

- 1a. Corolla lemon yellow; inflorescence a broad thyrs (cymose panicles) with pedunculate, compound cymes ..... *R. citrina*
- 1b. Corolla bright red; inflorescence racemose with opposite sessile fascicles of 1–10 flowers ..... 2a
- 2a. Corolla 4–6 cm long ..... *R. spicata*
- 2b. Corolla 2.5–3.3 cm long ..... *R. wilburii*

**Razisea citrina** D. Gibson, Fieldiana, Bot. 34: 78. 1972. Figure 14.

Suffrutescent plants to 2 m tall. Internodes between leaf-bearing nodes, 2.5–4.5 cm long, 1.5–3 mm thick, glabrous. Leaves petiolate, petioles 1.5–5.5 cm long, glabrous, leaves subtending inflorescence sessile or subsessile; laminae lanceolate, lanceolate-ovate or elliptic, 10–19.5 cm long, 5–9 cm broad, apically acuminate, basally acute to attenuate, glabrous on both surfaces, cystoliths dense and prominent on both surfaces. Inflorescences terminal, in broad thyrses (cymose panicles) 2–3-flowered; pedicels 5–15 mm long, glabrous; **bracts** subulate, 3–5 mm long, glabrous, bracteoles similar but smaller. Flowers with 5-merous calyx, **calyx lobes** long-subulate

7–9 mm long, glabrous; **corolla** lemon yellow, glabrous, 3.5–4.5 cm long, the tube ascending and curved outward, basally 3 mm broad, expanding to 5–11 mm broad at the mouth, upper lip erect, linear, minutely fimbriate, lower lip when open, forming an oblique angle from the upper lip, shallowly trilobate, the lobes ca. equal; **stamens** exserted 12–15 mm beyond the tip of the upper lip, anthers ca. 5 mm long. **Fruits** clavate, ca. 20–25 mm long, 4–4.5 mm broad, 2.5 mm thick, glabrous, seeds 4, ovate, 2–2.5 mm long, 1.5–2 mm broad, papillate.

I have seen only two specimens of this species: the holotype, Jiménez 2475 (F), collected in October in cloud forest area between Agua Buena

and San Vito (San Vito de Java), Puntarenas Province, 1200 m altitude, and *Weaver et al.* 1775 (DUKE), collected in August at 1000 m altitude, where it was described as a common shrub along a stream in the forest. Both specimens were in flower.

*Razisea citrina* is recognized by its broad terminal thyrses (cymose panicles) with lemon-yellow corollas. It is easily distinguished from other species of *Razisea* by these two features.

**Razisea spicata** Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 142. 1855. *Kolobochilus leiorhachis* Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica 9: 188. 1898, and in Pitt., Prim. fl. costaric. 2: 308. 1900. Figure 14.

Shrub to 2.5 m tall; internodes between leaf-bearing nodes 2–9 cm long, 2–4 mm thick, quadrangular, glabrous to infrequently, but densely, pilose. Leaves petiolate, petioles 1.0–3.5 (8.5) cm long, glabrous; laminae elliptic to ovate, 9.5–29 cm long, 3.5–8.5 cm broad, apically acuminate, basally attenuate, acute, obtuse, or rounded, margins entire to slightly crenate, glabrous above, glabrous to sparingly puberulous along the costa and veins beneath, cystoliths dense and prominent on both surfaces. Inflorescences in terminal racemes to 30 cm long, rachis puberulous to subglabrous, flowers numerous, solitary or in fascicles of 2–10 at opposite nodes, pedicels 5–10 mm long, puberulous, bracts subulate, 5–10 mm long, 1–2 mm broad, sparingly puberulous, bracteoles similar, but smaller. Flowers with 5-merous calyx, calyx lobes linear, 4.5–9 mm long, ca. 0.5 mm broad, puberulous; corolla bright red, funnelliform, ascending, slightly curved to one side, 4–6.2 cm long, glabrous, ca. 9 mm broad at the mouth, 1.5–2 mm broad basally, upper lip erect, linear, to ca. 8 mm long, 4 mm broad basally, apically rounded, the lower lip with 3 small, acute lobes at the tip, the lobes equal, ca. 1 mm long, the lower lip, when open, forming an oblique angle from the upper lip; stamens exerted 10–20 mm beyond the tip of the upper lip, the filaments to ca. 4.5 cm long, glabrous, anther cell 3–4 mm long, the bases rounded. Fruits clavate, 20–22 mm long, 3.5–4 mm broad, 3.0–3.5 mm thick, glabrous; seeds suborbicular, ca. 2.5 mm in diameter, tuberculate.

Found growing at the edges of light gaps and clearings in lowland rain forests and cloud forests, this species extends from Colombia to Guatemala. It has been collected from all provinces in Costa Rica at elevations of 50 to 1800 m. Flowering collections have been made from June through March.

*Razisea spicata* is recognized by its terminal racemes with pedicellate flowers either solitary or in fascicles of two to 10 at opposite nodes, its con-

spicuous bright red corollas, which are 4 to 6.2 cm long, funnelliform, ascending, and slightly curved outward from the rachis, and its two exserted stamens with single-celled anthers. This species is widespread and shows variation in number of flowers per node, length of corolla, length of calyx lobes (4.5 to 9 mm), and pubescence of young stems. It may be distinguished from the similar *R. citrina*, which has lemon yellow corollas and less variation in calyx lobe length (4.5 to 9 mm vs. 7 to 9 mm).

**Razisea wilburii** McDade, Syst. Bot. 7: 489. 1982.  
Figure 14.

Shrubs to 1.5 m tall; internodes between leaf-bearing nodes 1.5–5.5 cm long, 2–3 mm thick, puberulous to pilose mostly along 2 lines, trichomes white to reddish brown in a transverse banding pattern. Leaves petiolate, petioles 1.5–11.5 cm long, pubescence that of the stem; laminae ovate to elliptic or obovate, 12–23.5 cm long, 5–10 cm broad, apically acuminate, basally acute to obtuse, margins entire to crenate, glabrous above, moderately puberulous on costa and veins beneath, cystoliths dense and prominent on both surfaces. Inflorescences in terminal racemes borne singly or to 3, to ca. 30 cm long; flowers numerous, borne singly or in fascicles of 2–3 at opposite nodes, pedicels 2.5–6 mm long, sparingly puberulous; bracts subulate, 5–6.5 mm long, ca. 1 mm broad basally, ciliolate, bracteoles similar, but smaller. Flowers with 5-merous calyx, calyx lobes linear-subulate, 4–5 mm long, 0.5–0.75 mm broad basally, glabrous to sparingly puberulous; corolla bright red, funnelliform, ascending, slightly curved, 2.7–3.3 cm long, ca. 1.5 mm broad basally, sparingly puberulous, upper lip erect, ovate, 4–6 mm long, 2–3 mm broad, the lower lip truncate, shallowly trilobate, the lobes ca. 0.5 mm long, stamens exerted 3–8 mm beyond tip of the upper lip, anthers 3–3.5 mm long. Fruits clavate, 16–22 mm long, 3–4 mm broad, 3–3.5 mm thick; seeds 4, suborbicular, 2–3 mm in diameter, tuberculate.

This species is known mainly from the type locality, the Organization for Tropical Study Field Station, La Selva, on the Río Puerto Viejo near the town of Puerto Viejo de Sarapiquí. Numerous collections have been made at this locality, and it is assumed that the species occurs elsewhere in the Caribbean lowlands of northern Costa Rica. Flowering collections have been made in January, June, September, and October.

*Razisea wilburii* is recognized by its terminal racemes with pedicellate flowers either solitary or in fascicles of two to three at opposite nodes, its conspicuous bright red corollas which are 2.7 to 3.3 cm long, and its calyx lobe length of 4 to 5 mm. It is most easily confused with *R. spicata*,

which differs in its longer corolla (4 to 6.2 cm long) and mostly longer calyx lobes (4.5 to 9 mm vs. 4 to 5 mm long).

### Ruellia L.

**REFERENCES**—R. W. Long, A Biosystematic Approach to Generic Delimitation in *Ruellia* (Acanthaceae). *Taxon* 22(5/6): 543–555. 1973. R. W. Long, Biosystematic Observation on *Aphragmia inundata* (Acanthaceae) from Mexico. *Rhodora* 78: 17–24. 1976.

**Perennial herbs or shrubs.** Leaves mostly petiolate; laminae elliptic, ovate, ovate-lanceolate, oblong-spatulate, apically acuminate or obtuse, basally attenuate or acute, the margins entire or undulate, cystoliths present

and usually prominent on both surfaces. Flowers often large and showy, borne either singly or in various inflorescence forms which are either terminal or axillary or both, regular, sometimes curved, pedicellate or sessile; bracts 1 or absent; bracteoles 2 or absent. Flowers with a 5-merous calyx with mostly equal segments; corolla bluish, white, yellow, or red, funnelform, salverform, or sometimes saccate, the tubes usually narrow and the expanded portion often campanulate, with 5 spreading, obtuse lobes; stamens 4, didynamous, the anthers 2-celled, basally muticous; stigma lobes unequal. Capsule oblong or clavate, the disseipiment remains attached to the capsule wall at maturity; seeds flattened and, when moist, rimmed by sticky, mucilaginous hairs, appearing glabrous when dry.

This is the second largest genus of the Acanthaceae, with approximately 250 species distributed worldwide. Most species are found in the tropics, but a few extend into temperate regions.

### Key to Species of *Ruellia*

- 1a. Bracts, calyx, young leaves, and branches of inflorescence all with numerous glandular hairs; calyx segments unequal in length ..... 2a
- 1b. Bracts, calyx, young leaves, and branches of inflorescence not all with numerous glandular hairs; calyx segments equal in length ..... 5a
  - 2a. Capsules clavate; calyx with 1 segment conspicuously longer than the others ..... *R. inundata*
  - 2b. Capsules elliptic or cylindric; calyx segments unequal, but none conspicuously longer than the others ..... 3a
    - 3a. Leaves and bracts gland-dotted ..... *R. gulfodulcensis*
    - 3b. Leaves and bracts lacking gland-dots ..... 4a
      - 4a. Stamens slightly exserted; calyx segments 9–11 mm long ..... *R. paniculata*
      - 4b. Stamens included; calyx segments 16–20 mm long ..... *R. nudiflora*
- 5a. Corolla 6 cm or longer; capsules 22 mm long or greater ..... 6a
- 5b. Corolla 5.5 cm long or less; capsules 20 mm long or less ..... 10a
  - 6a. Inflorescences spicate; laminae and bracts gland-dotted; calyx lobes 3.5–4 mm long ..... 7a
    - 7a. Young stems puberulous; laminae puberulous only on costa and veins beneath ..... *R. tubiflora* var. *tetrapetala*
    - 7b. Young stems subtoomentose; laminae pilose on both surfaces ..... *R. tubiflora* var. *hirsuta*
  - 8a. Plants cultivated; inflorescences paniculate; bracts 4–10 mm long ..... *R. malacosperma*
  - 8b. Plants native; flowers axillary and solitary to clusters of 5; bracts 18–40 mm long ..... 9a
    - 9a. Flowers sessile, stamens included; bracts sericeous plus glandular hairs ..... *R. praeculta*
    - 9b. Flowers on pedicels 2–4 mm long, stamens exserted to just beyond the mouth; bracts glandular-puberulous ..... *R. palustris*
- 10a. Leaves and bracts gland-dotted ..... *R. gulfodulcensis*
- 10b. Leaves and bracts lacking gland-dots ..... 11a
  - 11a. Plants cultivated for large showy flowers; capsules 25–30 mm long ..... *R. malacosperma*
  - 11b. Plants native; capsules 6.5–20 mm long ..... 12a
    - 12a. Capsules elliptic; younger stems with glandular hairs ..... *R. nudiflora* var. *puberula*
    - 12b. Capsules clavate; younger stems lacking glandular hairs ..... 13a
      - 13a. Flowers in compact cymes (often appearing fascicled) at the ends of long unbranched peduncles; corollas puberulous-glandular ..... *R. biolleyi*

- 13b. Flowers in spikes, spicate panicles, dichotomously branching panicles, or flowers axillary and solitary to clusters of 2–4; corollas eglandular ..... 14a
- 14a. Flowers axillary and solitary to clusters of 2–4 and some of these occasionally on peduncles no more than 5 cm long ..... 15a
- 14b. Flowers in spikes, spicate panicles or dichotomously branching panicles ..... 18a
- 15a. Corollas 4.5–7 cm. long; capsules 14–20 mm long ..... *R. jussiaeoides*
- 15b. Corollas 2–3.5 cm long; capsules 6.5–13 mm long ..... 16a
- 16a. Capsules 6.5–8 mm long; leaves sessile or with petioles to 4 mm long ..... *R. geminiflora*
- 16b. Capsules 11–13 mm long; leaves with petioles 5–15 mm long ..... 17a
- 17a. Corolla puberulous; uppermost bracts 2–4 cm long; capsule minutely puberulous ..... *R. metallica*
- 17b. Corolla glabrous; bracts less than 15 mm long; capsules glabrous ..... *R. barbillana*
- 18a. Corollas 2.8–3.2 cm long; capsules 15–20 mm long; calyx in fruit 6–10 mm long ..... *R. stemonacanthoides*
- 18b. Corollas 2.2–2.8 cm long; capsules 12–15 mm long; calyx in fruit 2–5 mm long ..... 19a
- 19a. Capsule and calyx lobes puberulous plus glandular hairs; peduncle angled, but not winged ..... *R. cooperi*
- 19b. Capsule and calyx lobes puberulous to glabrous, but eglandular; peduncle angled and slightly winged ..... 20a
- 20a. Peduncles mostly less than 10 cm long, glabrous; younger stems glabrous; bracts elliptic-oblong ..... *R. tonduzii*
- 20b. Peduncles mostly more than 10 cm long, sparingly puberulous; younger stems puberulous; bracts oblong-spatulate ..... *R. pittieri*

**Ruellia barbillana** Cufodontis, Arch. Bot. Sist. 10:  
47. 1934.

**Herbs** to 40 cm tall. **Stem** quadrangular, bearing numerous punctiform cystoliths, retrorse hairs at the angles. **Leaves** on petioles 1–1.5 cm long; laminae ovate-lanceolate, to 10 cm long, 2.5 cm broad, apically acuminate, basally attenuate, margins subrepand or undulate, glabrous above, glabrous to appressed-hirsute on the costa and veins beneath, cystoliths visible on both surfaces. **Inflorescences** of clustered cymes borne in the axils of the upper leaves, **bracts** and bracteoles small. **Flowers** sessile, with 5-merous calyx, calyx 5 mm long, segments subulate; **corolla** pale purple, ca. 3 cm long, glabrous, 2 mm broad basally, 6 mm broad at the throat, the limb spreading, the lobes ovate, rounded, ca. 8 mm long, 6 mm broad; **stamens** included. **Fruits** glabrous, seeds 6.

This species is known only from the type collection which was made on the bank of Río Barbillá near Finca Waldeck in Limón Province. The above description was adapted from the original.

*Ruellia barbillana* is recognized by its inflorescences of clustered cymes borne in the axils of upper leaves, its sessile flowers with bracts less than 15 mm long, its purplish, glabrous corollas about 3 cm long, and its glabrous capsules. It is most easily confused with the more common and widespread *R. metallica*, which differs in its longer bracts (2 to 4 cm long) and its puberulous corollas and capsules.

**Ruellia bolleyi** Lindau, in Anales Inst. Fís.-Geogr. Nac. Costa Rica 9: 188. 1898, and in Pitt., Prim. fl. costaric. 2: 301. 1900. *Ruellia longissima* D. Gibson, Fieldiana, Bot. 34: 79. 1972. Figure 15.

**Herbs** to 1 m tall, stems erect; internodes between leaf-bearing nodes 1–14 cm, 1–3.5 mm thick, quadrangular, yellow pilosulous. **Leaves** petiolate, petioles 8–22 mm long, yellow pilosulous; laminae elliptic, 3.5–14 cm long, 2–5 cm broad, apically acuminate, basally attenuate, margins undulate, glabrous above, puberulous (often yellow) along costa and main veins beneath, cystoliths dense and prominent on both surfaces. **Inflorescences** in axillary cymes, peduncles 10–23 cm long, quadrangular, slightly winged, sparingly puberulous; **flowers** sessile to pedicels ca. 2 mm long, often in compact fascicles, lower bracts leaflike, elliptic to spatulate, to 15 mm long, upper bracts similar, but smaller. **Flowers** with 5-merous calyx, calyx segments long-subulate, 4–5 mm long, glandular-puberulous; **corollas** violet or purplish, 20–24 mm long, unexpanded portion of tube ca. 10 mm long, ca. 1 mm broad basally, 5.5–7 mm broad at mouth, puberulous plus some glandular hairs outside; **stamens** included, anthers basally rounded. **Fruits** clavate, 13–17 mm long, 3.4–4.0 mm broad, 1.4–1.5 mm thick, glandular-puberulous, more so at the stipe; seeds 4–8, orbicular, 1.8–2 mm in diameter.

Found in lowland rain forest areas of Panama and Costa Rica. In Costa Rica it has been collected in mature or recently cut lowland rain forests from near sea level to 300 m elevation in Heredia and

Limón provinces. Flowering collections have been made in Costa Rica in January, February, March, July, and August.

*Ruellia bolleyi* is recognized by its long, peduncled (10 to 23 cm long) inflorescences bearing compact, near-sessile flowers in compact cymes. The flowers often appear fascicled at the ends of these long peduncles. Further, it is recognized by its violet or purplish, puberulous-glandular corollas (20 to 24 mm long) with included stamens, glandular-puberulous calyx segments (4 to 5 mm long), and 4- to 8-seeded glandular-puberulous capsules, which are 13 to 17 mm long. It resembles *R. cooperi*, which differs in the more extensive branching of its inflorescence, thus lacking the often-fascicled flowers, a white corolla (which may turn purplish with age) that is slightly longer (2.5 to 2.8 cm long), and a puberulous calyx and fruit (vs. glandular-puberulous).

I have placed *R. longissima* D. Gibson in synonymy here because all of its characteristics lie within the range of those described for the more widespread and variable *R. bolleyi*.

***Ruellia cooperi*** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1251. 1938. Figure 15.

**Herbs** to ca. 1.5 m tall, stems erect; **internodes** between leaf-bearing nodes 3–12 cm long, 2–2.8 mm thick, terangular, subglabrous. **Leaves** on puberulous petioles 1–3.5 cm long; laminæ elliptic, 5–16 cm long, 1.6–6 cm broad, apically acuminate, basally attenuate, margins undulate, glabrous above, puberulous on veins beneath, cystoliths dense and prominent on both surfaces. **Inflorescences** of peduncled, axillary, dichotomously branching panicles, the peduncles 8–30 cm, but mostly more than 15 cm long, sharply terangular, glabrous, the branches frequently curving; **flowers** borne singly or in pairs at the axils of the branches or at their terminus; **bracts** elliptic to spatulate, lower bracts leaflike, 20–25 mm long, 6–8 mm broad, upper bracts much smaller, all glabrous. Flowers with 5-merous calyx, lobes 2–5 mm long, puberulous plus occasional glandular hairs; **corolla** white or pale lavender, 2.3–2.5 cm long, sparingly puberulous, unexpanded portion of tube ca. 1 cm long, 7–8 mm broad at the mouth, 1.5 mm broad basally; stamens included. **Fruits** clavate, 13–14 mm long, 3–3.6 mm broad, ca. 2 mm thick, puberulous plus occasional glandular hairs.

Found at lower altitudes of Panama and Costa Rica. Only one collection, *Burger, Visconti and Gentry 10643 (GRI)* from near Quepos, Puntarenas Province, has been seen. This was collected in February on shaded slopes above a stream in rain forest.

*Ruellia cooperi* is recognized by its inflorescences of dichotomously branching panicles on long peduncles (8 to 30 cm long), capsules which are puberulous with occasional glandular hairs, and white to pale lavender corollas which are sparingly puberulous. It most closely resembles *R. bolleyi*, which differs in its inflorescences, with cymose flowers that are short-pedicelled and often fascicled, and its violet or purplish corollas which are puberulous with some glandular hairs.

***Ruellia geminiflora*** Kunth in H.B.K., Nov. gen. sp. 2: 240. 1817. Figure 15.

Ascending herbs to ca. 50 cm tall; **internodes** between leaf-bearing nodes 1.5–5.5 cm long, 1–1.5 mm thick, quadrangular, appressed pilose mostly at the angles. **Leaves** sessile to petioles 4 mm long; laminæ ovate to ovate-elliptic, 4–7 cm long, 0.9–2.2 cm broad, apically acute, basally attenuate, margins entire to crenulate, mature leaves pilose beneath, young leaves and those surrounding the flowers densely puberulous to tomentose, cystoliths densely distributed over both surfaces where visible. Pedicels axillary, borne singly or in pairs, ca. 1 mm long. **Flowers** with 5-merous calyx, lobes equal, subulate, 5–7 mm long, 0.8–1 mm broad basally, puberulous, ciliate; **corolla** mauve, funnelform, 2.1–3.5 cm long, puberulous, unexpanded portion of tube 8–13 mm long, ca. 1 mm broad, 6–9 mm broad at the mouth, lobes equal, suborbicular, 6–10 mm broad; **stamens** included, the filaments glabrous; ovary and style puberulous. **Fruit** clavate, 6.5–8 mm long, 3.3–3.7 mm broad, 2–2.8 mm thick, puberulous; seeds 4, orbicular, flattened, 2–3 mm in diameter.

This species is found in open grassland areas of Central America, the West Indies, and northern South America. In Costa Rica it has been collected in the Pacific watershed areas of Alajuela and Guanacaste provinces often in secondary succession following burning. Collections in Costa Rica have been made at altitudes of 150 to 500 m. Flowering collections have been made in January, February, March, May, and June.

*Ruellia geminiflora* is recognized by its relatively small, subsessile leaves (4 to 7 cm long), its axillary, short-pedicelled flowers borne singly or in pairs with mauve corollas (2.1 to 3.5 cm long), and its short, stout, clavate, puberulous capsules (6.5 to 8 mm long). It may be confused with *R. metallica*, which has larger, petiolate, often lustrous leaves (to 15 cm long), inflorescences with sessile, axillary flowers in fascicles of three to four, linear to linear-elliptic bracts (2 to 4 cm long) which intergrade with leaves basally, and its clavate capsules (11 to 13 mm long).

**Ruellia golfdulcensis** Durkee, sp. nov. Figure 15.

Herbae suffruticosae, usque ad 1 m altae, caulis erectis, glabris. Folia petiolata, laminis ellipticis, 7–15 cm longis, 1.4–4 cm latis, apice acuminatis, basi longe attenuatis, subglabris et glanduloso-punctatis, cystolithis supra prominentibus. Inflorescentiae terminales, racemosae, angustae, vel in specimenibus junioribus flores axillares solitarii. Flores corollis albis infundibuliformibus, ca. 4 cm longis, staminibus inclusis. Fructus non visi.

**Suffrutescent** plant to 1 m tall, **stems** erect; **internodes** between leaf-bearing nodes 1.7–8 cm long, 1–2 mm thick, tetrangular, glabrous, uppermost internodes gland-dotted. **Leaves** on glabrous petioles 5–15 mm long; laminae elliptic, 7–15 cm long, 1.4–4 cm broad, apically acuminate, basally long-attenuate, margins entire, sparingly ciliolate, subglabrous and gland-dotted on both surfaces, gland-dots more prominent in younger leaves, cystoliths visible on both surfaces but more prominent above. **Inflorescences** of narrow, terminal racemes in older specimens, with axillary flowers borne singly in younger specimens; **bracts** lanceolate, 15–26 mm long, 3–6 mm broad, gland-dotted, margins ciliolate. **Flowers** on glandular-puberulous pedicels 3–5 mm long; calyx 5-merous, lobes linear, subequal, 13–20 mm long, 0.75–1.0 mm broad, glandular-puberulous; **corolla** white, funnelform, ca. 4 cm long, sparingly glandular-puberulous, tube 2.8 cm long, unexpanded portion of tube 1.5 cm long, lobes rounded, 17 mm long, 6 mm broad; **stamens** included. **Fruits** not observed.

**TYPE**—Costa Rica; Puntarenas Prov., Golfo Dulce and Río Grande de Térraba, elevation 1600 m, undershrub in forest, December 1947, Skutch 5304 (holotype, US). **Additional Collections**: Puntarenas Province, Golfo Dulce area, vicinity of Esquinas Experiment Station, elevation sea level, common, April 26, 1949, Allen 5266 (US). Flowering collections were made in April and December.

*Ruellia golfdulcensis* is recognized by its short-pedicellate flowers with a conspicuously glandular-puberulous calyx with subequal, linear lobes (13 to 20 mm long); white, glandular-puberulous corollas (ca. 4 cm long) borne singly at leaf or bract axils; leaves and bracts which are gland-dotted. It most closely resembles the much wider-ranging *R. metallica* of similar habitats, which differs in its leaves which lack glandular dots, shorter calyx lobes (5 to 7 mm long) which are subulate, and shorter corolla (2.3 to 2.7 cm long) which is puberulous only.

**Ruellia inundata** Kunth in H.B.K., Nov. gen. sp. 2: 239. 1817. Figure 15.

**Herbs** sometimes suffrutescent, to 1.5 m tall; **internodes** between leaf-bearing nodes 2–7.5 cm long, 2.1–

2.8 mm thick, subquadrangular, pilose. **Leaves** on pilose petioles 1–8.5 cm long; laminae ovate to ovate-lanceolate, 4–15 cm long, 1.2–8 cm broad, apically acuminate, basally attenuate, margins denticulate, pilose above and beneath, young leaves glandular-puberulous, cystoliths common, but more visible above. **Inflorescences** of ascending axillary dichasia which often form dense panicles, pedicels 8–30 mm long, glandular-pubescent; **floral bracts** paired, lanceolate, often slightly unequal, 3–5 mm long, 0.8–1.4 mm broad, puberulous-glandular, lower bracts similar, but larger. **Flowers** with 5-merous calyx, segments linear, 10–14 mm long, 1 segment conspicuously longer (ca. 2 mm) than the others, glandular-puberulous; **corolla** pink or mauve, narrowly funnelform, the tube slightly curved, 2.2–2.5 cm long, 1–1.2 mm broad basally, 3–4 mm broad at the mouth, glabrous to sparingly puberulous, the 5 lobes equal, rounded 4–5.5 mm long, 3–3.5 mm broad; **stamens** included. **Fruits** clavate, 8–10 mm long, 2.4–3.1 mm broad, 1.2–2 mm thick, glabrous; seeds 2–4, flattened, orbicular, 2.0–2.5 mm in diameter.

This is a common species growing in open or partially shaded areas that have been recently disturbed, such as roadsides and trails. Its range extends from Mexico to much of South America. In Costa Rica it has been collected only on the Pacific watershed at altitudes of 50 to 900 m in Alajuela, Guanacaste, Puntarenas, and San José provinces. Flowering collections have been made from November through March.

*Ruellia inundata* is recognized by its ascending axillary dichasia that often form dense panicles; pink or mauve, narrowly funnelform corollas (2.2 to 2.5 cm long, excluding lobes); small, paired, lanceolate bracts (3 to 5 mm long) which are often slightly unequal in length; and a glabrous, clavate capsule (8 to 10 mm long). Bracts, calyx, pedicels, and young leaves all have numerous glandular hairs which give fresh specimens a fetid odor. It is most easily confused with *R. paniculata*, which can be distinguished by its cylindric capsules (10 to 13 mm long) and slightly exerted stamens.

Long (1976) presents evidence suggesting that *R. inundata* belongs in the genus *Aphragmia* on the basis of hybridization experiments as well as morphological comparisons with *R. tuberosa*, the type for the genus, and *R. carolinensis*. However, Long does not mention comparisons between *R. inundata* and *R. paniculata* with which it is often confused because of morphological similarities. *Ruellia paniculata* is found in similar habitats and extends over the same wide range from Mexico to Brazil. *Ruellia paniculata* differs from *R. inundata* in ways that suggest closer affinity to *R. tuberosa*, with its bluish corolla and cylindrical capsule (vs. red or pink corolla and clavate capsule), suggesting

that *R. paniculata* does belong in the genus. Until the relationships among *R. inundata*, *R. paniculata*, and other species clearly regarded as within the genus *Ruellia* are more thoroughly investigated, I have decided to recognize *R. inundata* as *Ruellia*.

***Ruellia jussieuoides*** Schlecht., Linnaea 6: 370. 1830. *Ruellia achimeniflora* (Oerst.) Hemsl., Biol. Centralbl. 2: 503. 1882. *Arrhostoxylum achimeniflorum* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 131. 1881. Figure 15.

**Herbs** or **suffrutescent** plants to 2.5 m tall; **internodes** between leaf-bearing nodes 3–14 cm long, 2–4 mm thick, **tetragonal**, puberulous mostly at the angles. **Leaves** petiolate, petioles 1–3 cm long, puberulous; laminae, elliptic, elliptic-ovate or lanceolate, 5–14.5 cm long, 2–5.5 cm broad, apically long-acuminated, basally attenuate, margins entire to crenulate, sparingly pilose to pilose above, pilose beneath, veins and veinlets conspicuous above in dried specimens, cystoliths dense and prominent on both surfaces. **Inflorescences** axillary, flowers sessile and solitary to clusters of 2–3 at the ends of puberulous peduncles 0.25–5 cm long; **bracts** lanceolate-elliptic, 2–4 cm long, 5–10 mm broad, puberulous, bracteoles similar though smaller. Flowers with 5-merous **calyx**, calyx lobes subequal, long-subulate, 1 lobe often slightly longer than the rest, 6–20 mm long, 0.8–1 mm broad basally, ciliolate, puberulous; **corolla** lavender or purple, funnelform, frequently curved, puberulous outside, the tube 3.3–5.5 cm long, ca. 1 mm broad basally, expanding to 5–10 mm broad at the mouth, the lobes subequal, suborbicular, 10–18 mm in diameter; **stamens** included, anthers ca. 3 mm long. **Fruits** clavate, 14–20 mm long, 3.5–5 mm broad, ca. 2.6 mm thick, puberulous plus minute glandular hairs; seeds 10–14, elliptic, flattened, ca. 2.5 mm long, 2 mm broad, puberulous, when wet, margins covered with dense, mucilaginous hairs.

Ranging from southern Mexico to Costa Rica, this species is found from 300 to 1500 m elevation in Costa Rica where it has been collected mainly in openings and along trails in rain forests around San José and Cartago provinces, although several collections have been seen from the vicinity of San Isidro of Puntarenas Province. Flowering collections have been made from November through April.

*Ruellia jussieuoides* is recognized by its axillary inflorescences with sessile flowers solitary to clusters of two to three at the ends of peduncles 0.25 to 5 cm long, corollas lavender or purple with tubes 3.3 to 5.5 cm long, stamens included, fruits 14 to 20 mm long, puberulous. It resembles *R. tubiflora* var. *tetrastichantha*, which differs by its

flowers borne in terminal or lateral spikes resulting in a conical rachis, bracts and calyx lobes that are gland-dotted, and white corollas which are 7 to 8 cm long. *Ruellia malacosperma* also resembles *R. jussieuoides*, but differs with its dichotomously branched cymose inflorescences and its pedicellate flowers. I have placed *Ruellia achimeniflora* in synonymy with *R. jussieuoides* because I can find no characters that differ consistently between these two taxa. *Ruellia jussieuoides* is much wider ranging, and it appears that *R. achimeniflora* is a population which differs mainly in wider leaves, but this variation is inconsistent.

***Ruellia malacosperma*** Greenm., Proc. Amer. Acad. Arts 34: 572. 1899.

**Herbs** to 60 cm tall; **internodes** between leaf-bearing nodes 1.5–8.5 cm long, 1.8–2.2 mm thick, quadrangular, sparingly pilose. **Leaves** on glabrous petioles 0.5–2 cm long; laminae narrowly elliptic 5–15 cm long, 1–3.4 cm broad, apically acute or obtusish, margins undulate to entire, glabrous above and beneath, cystoliths visible on both surfaces. **Inflorescences** of ascending axillary dichasia that branch once or twice, peduncles quadrangular to 9 cm long, glabrous pedicels 5–15 mm long, sparingly glandular-puberulous; **bracts** linear 4–10 mm long, 1–1.5 mm broad, glabrous. **Flowers** with 5-merous **calyx** with lobes long-subulate, 10–12 mm long, ca. 1.25 mm broad basally, glandular-puberulous; **corolla** mauve or purple, 4.5–5.5 cm long, cylindrical portion ca.  $\frac{1}{3}$  the length, 2.3–3 mm broad, the throat funnelliform, ca. 3 cm broad at the mouth, the lobes rounded, ca. 10 mm long, 1.5–1.8 mm broad; the **stamens** included. **Fruits** narrowly clavate, 2.5–3 cm long, 6 mm broad, glabrous; seeds 8–20, discoid, ca. 3 mm in diameter, silky with white, appressed hairs when dry.

This species is native to Mexico, but is cultivated throughout much of tropical America, including Costa Rica, and especially the central valley area. The only Costa Rican collection I have examined was from Parque Bolívar of La Honduras, San José Province. It was collected in flower in June.

*Ruellia malacosperma* is recognized by its simple panicles with one or two dichotomous branches on peduncles to 9 cm long, its large, showy, mauve or purple corollas (4.5 to 5.5 cm long), and its large, narrowly clavate, glabrous capsules (2.5 to 3 cm long). It has been confused with *R. stemonanthoides*, which has smaller corollas (3 to 4 cm long) and shorter capsules (15 to 20 mm long). It also may be confused with *R. paniculata*, which has shorter corollas (3 to 4 cm long) and shorter, cylindric, glabrous to sparingly puberulous capsules.

**Ruellia metallica** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1253. 1938. Figure 16.

Suffrutescent herb to 1 m tall; internodes between leaf-bearing nodes 1–9.5 cm long, 1–3 mm thick, subquadangular, sparingly puberulous mostly at the angles. Leaves on glabrous petioles 5–13 mm long, glabrous. Laminae elliptic to elliptic-ovate, varying from broadly to narrowly so, 4–17 cm long, 1–8 cm broad, apically acuminate, basally attenuate, margins undulate, glabrous above, sericeous on the costa and veins beneath, cystoliths prominent above and beneath, upper surface often faintly lustrous or purplish, the lower surface often purplish or violet purple beneath, especially in younger leaves. Inflorescences axillary or terminal with sessile flowers in fascicles of 3–4; uppermost bracts linear to linear-elliptic, 2–4 cm long, lower bracts intergrading with leaves. Flowers with calyx segments equal, subulate, 5–7 mm long, glabrous except scant puberulence at the margins; corollas lavender, pink, or white, funneliform, 2.3–2.7 cm long, puberulous, cylindrical portion ca. 1.5 mm broad, 10 mm broad at the mouth, lobes suborbicular, 5–7 mm in diameter; stamens included. Fruits clavate, 11–13 mm long, 2.5–3.2 mm broad, 2.2–2.6 mm thick, minutely puberulous; seeds 2, suborbicular, 2.5–2.8 mm in diameter.

This species occurs in and adjacent to lowland rain forest areas ranging from Guatemala to Panama. In Costa Rica it has been collected in moist areas of both watersheds, excluding Guanacaste and San José provinces. Flowering collections have been made in January, February, March, May, June, September, and December.

*Ruellia metallica* is recognized by its terminal spikelike inflorescences with axillary fascicles of three to four sessile flowers subtended by bracts which are linear to linear-elliptic (2 to 4 cm long) near the apex, but intergrading with leaves basally, its lavender, pink, or white corollas (2.3 to 2.7 cm long), its clavate, minutely puberulous capsules (11 to 13 mm long), and its leaves which are often purplish or violet purple beneath, lustrous or purplish above. It is most easily confused with *R. geminiflora*, which differs with its smaller (4 to 7 cm long) sessile to short petiolate leaves, its inconspicuous bracts, its inflorescences with pedicellate, axillary flowers in fascicles of one to two, and its clavate capsules (6.5 to 8 mm long).

**Ruellia nudiflora** (Engelm. & Gray) Urb., Symb. antill. 7: 382. 1912. *Dipteracanthus nudiflorus* Engelm. & Gray, Boston J. Nat. Hist. 5: 229. 1845. *Ruellia nudiflora* (Engelm. & Gray) Urb. var. *puberula* Leonard, J. Wash. Acad. Sci. 17: 517. 1927. *Ruellia puberula* (Leonard) Tharp & Barkley, Amer. Midl. Naturalist 42: 17. 1949. Figure 16.

Herbs to 30 cm tall; internodes between leaf-bearing nodes 1–8 cm long, 1.4–2.7 mm thick, quadrangular, glandular-puberulous plus occasional larger pilose hairs. Leaves on glandular-puberulous petioles 0.4–3.2 cm long; laminae elliptic to obovate, 3.5–11.5 cm long, 1.3–3.7 cm broad, apically acute, obtuse or rounded, basally attenuate, margins undulate, puberulous above mixed with occasional pilose hairs, similar beneath, but densely puberulous, cystoliths dense, more visible above, obscured by hairs beneath. Inflorescences of axillary dichasia, peduncles 2–8 cm long, glandular-puberulous, pedicels 0.5–2 cm long, glandular-puberulous, bracts oblong, 7–9 mm long, glandular-puberulous. Flowers with calyx lobes linear-subulate, equal, 16–20 mm. long, glandular-puberulous; corolla light blue or lavender, funneliform, 3.5–4.5 cm long, tube ca. 2 mm broad basally, expanding to 8–15 mm broad at the mouth, puberulous, the lobes suborbicular, 9–11 mm broad; stamens included. Fruits elliptic, 16–18 mm long, 2.5–4 mm broad, puberulous; seeds ca. 12, ovate, basally asymmetrical, ca. 2.5 mm long, 2.0 mm broad.

Found in dry savannas and pastures, this species survives burning and is then conspicuous for its showy flowers appearing close to the ground after growth is resumed. This variety ranges from Oaxaca to central Panama. In Costa Rica it is found at elevations of 25 to 100 m in the lowlands of Guanacaste. Flowering collections have been made in January, February, May, and June.

*Ruellia nudiflora* is recognized by its puberulous, elliptic to obovate laminae, its axillary dichasia on glandular-puberulous peduncles to 8 cm long bearing pedicellate flowers with light blue or lavender corollas 3.5 to 4.5 cm long with stamens excluded, and its puberulous, elliptic capsules 16 to 18 mm long. It may be confused with *R. paniculata*, which differs in its elliptic to ovate leaves, its corollas with stamens slightly exserted, and its glabrous, cylindric capsule (10 to 13 mm long).

**Ruellia palustris** Durkee, sp. nov. Figure 16.

Herbae suffruticosae, usque ad 1 m altae, caulis erectis, junioribus pilosis-adpressis. Folia petiolata, laminis ellipticis vel elliptico-obovatis, 5.5–15.5 cm longis, 2.2–8.5 cm latis, apice acuminatis, basi acutis vel parum attenuatis, maximam partem glabris, cystolithis abundantibus. Inflorescentiae fasciculatae, axillares et terminales, 1–5 floribus, bracteis 2 in quoque flore. Flores corollis albis infundibuliformibus, tubis 6–7 cm longis et lobis 1.6–2 cm longis, staminibus paulo exsertis. Fructus clavati, ca. 23 mm longi.

Suffrutescent herb to 1 m tall; stems erect; internodes between leaf-bearing nodes 3–15 cm long, 2–4 mm thick, appressed-pilose. Leaves petiolate, petioles 6–18 cm long,

appressed-pilose; laminae elliptic to elliptic-obovate, 5.5–15.5 cm long, 2.2–8.5 cm broad, apically abruptly acuminate, basally acute to slightly attenuate, margins entire to slightly undulate, glabrous on both surfaces except for appressed hairs on costa and main veins, cystoliths abundant and visible on both surfaces. Inflorescences in axillary and terminal clusters of 1–5 flowers, flowers borne on short pedicels 2–4 mm long, strigose; bracts 2 per flower, shape variable from broadly elliptic to obovate or oblanceolate, 3–4 cm long, 0.6–2.3 cm broad, apically acute, glandular-puberulous. Flowers with a 5-merous calyx, calyx lobes equal, long-elliptic to lanceolate, 25–30 mm long, 4–5 mm broad, glandular-puberulous; corolla white, funnelform, the tube 6–7 cm long, cylindrical portion 4.5–5 cm long, 3.5–4 mm broad, funnelform portion 1.5–2 cm long, 10–16 mm broad at the mouth, glandular-puberulous, the lobes equal, suborbicular, 1.6–2 cm long, 2–2.5 cm broad; stamens exserted to just beyond the mouth, anthers 4–5 mm long, ca. 0.8 mm broad, filaments attached at ca. the beginning of the funnelform portion of the corolla tube. Fruits clavate, ca. 23 mm long, 8 mm broad, 8 mm thick, puberulous; seeds 8.

**TYPE**—Costa Rica: Heredia Prov. Collected at swamp's edge in mature rain forest at Finca La Selva on Río Puerto Viejo, elev. ca. 100 m, 27 July 1980, Hammel 9341 (Holotype, DUKE). **Additional Collections**—All from the same vicinity and similar habitat, Grayum 1467, 2428 (DUKE); Hammel 10480 (DUKE), McDade 364 (DUKE); Damon Smith 614 (DUKE). Flowering collections have been made in July, August, and November.

*Ruellia palustris* is recognized by its large white corollas (6 to 7 cm long) with two-thirds of the tube cylindrical, the two large, mostly elliptic bracts per flower and with axillary and terminal flowers in clusters of one to five. It most closely resembles *R. praeclara* of similar habitats in western Panama and southeastern Costa Rica, which differs in its shrubby habit, longer corollas (to 9 cm), and linear bracts and calyx lobes.

***Ruellia paniculata* L., Sp. pl. 2: 635. 1753. Figure 16.**

Herbs to suffrutescent plants; internodes between leaf-bearing nodes, 2–6.5 cm long, 1.8–3.5 mm thick, quadrangular, glandular-puberulous. Leaves on petioles 0.5–4 cm long, glandular-puberulous; laminae ovate to elliptic, 3–10(17) cm long, 1.5–4.5 (6.5) cm broad, apically acute to obtuse, basally abruptly attenuate, margins undulate, glandular-puberulous plus occasional pilose hairs on both surfaces, but more dense and prominent above, less so beneath. Inflorescences in axillary, branching dichasia forming dense clusters in mature plants, the branches glandular-puberulous; floral bracts narrowly elliptic to obovate, 3–5 mm long, 0.5–0.7 mm broad, glandular-puberulous, lower bracts larger intergrading with

the leaves. Flowers with calyx segments elongate-subulate, unequal, 9–11 mm long, basally 0.7–0.8 mm broad, glandular-puberulous; corolla light blue, funnelform, puberulous, 2.5–4 cm long, unexpanded portion of tube ca. 1.3 cm long, 1–1.2 mm broad, lobes suborbicular, 6–7 mm broad; stamens slightly exserted. Fruits cylindric, 12.5–15 mm long, 2–2.5 mm in diameter, glabrous to minutely puberulous apically; seeds 8, flat, ovate, ca. 2 mm long, 1.5 mm broad.

This species is wide ranging from Mexico to Brazil where it grows in open disturbed habitats with a dry season at elevations of sea level to 200 m. It is not frequently collected, either because it is uncommon or, as I suspect, it is mistaken for the much more common *R. inundata* of similar habitats. Only two Costa Rican collections have been observed from the Bagaces and Cañas areas of Guanacaste, both in flower—one in January, the other in April.

*Ruellia paniculata* is recognized by its dense axillary dichasia, with most parts bearing a dense glandular-puberulence, blue corollas (2.5 to 4 cm long) with slightly exserted stamens, and cylindric capsules (12.5–15 mm long). It is most often confused with *R. inundata* of similar habitat, which differs in its pink or mauve corollas, included stamens, and clavate capsules (8 to 10 mm long).

***Ruellia pittieri* Lindau, Bull. Herb. Boissier 5: 655. 1897. *Ruellia longissima* var. *glabra* D. Gibson, Fieldiana, Bot. 34: 80. 1972. Figure 16.**

Herbs to suffrutescent plants to 2 m tall; internodes between leaf-bearing nodes, 2.8–11.5 cm long, 3–3.8 mm thick, quadrangular, puberulous. Leaves on petioles 2–6.5 cm long, puberulous; laminae ovate to ovate-elliptic, 7–12 (19) cm long, 2.5–7 (8.5) cm broad, apically acuminate, basally acute to obtuse, margins undulate, glabrous above, puberulous on costa and veins beneath, cystoliths dense and prominent on both surfaces. Inflorescences in axillary, lax, spicate panicles that are often dichotomously branching; peduncles 12–21 cm long, peduncles and branches sparingly puberulous and slightly winged; nonfloral bracts oblong-spatulate, 15–35 mm long, glabrous; floral bracts elliptic, 4–8 mm long, 1–2 mm broad, glabrous. Flowers sessile to subsessile, with calyx segments subulate, 2–3 mm long at anthesis, 3.5–5 mm long at fructescence, ca. 0.5 mm broad basally, sparingly puberulous; corolla light blue or pale violet, funnelform, 2.3–2.8 cm long, puberulous, unexpanded portion of tube 8–10 mm long, 1–1.5 mm broad, 5–10 mm broad at the mouth, lobes equal, obtuse, 5.5–7 mm long, 5–7.5 mm broad; stamens included. Fruits clavate, 12–15 mm long, 3–4 mm broad, 1.9–2.2 mm thick, sparingly puberulous to glabrous; seeds 4, 6, or 8, suborbicular, 2.2–2.8 mm in diameter.

This species is commonly found along streams and other openings in wet forests of Costa Rica and Panama. In Costa Rica it is found in southern Puntarenas Province at elevations of 30 to 270 m. Most collections have been made in the Golfo Dulce area and on the Burica Peninsula. Flowering collections have been made in December, March, and April.

*Ruellia pittieri* is recognized by its lax, dichotomous, spicate panicles, with slightly winged, tetragonal peduncles (and branches) which usually exceed 10 cm in length; its oblong-spatulate bracts, its funnelform corollas (2.3 to 2.8 cm long), and its clavate capsules (12 to 15 mm long). It is easily confused with *R. stemonacanthoides*, which differs in its longer corollas (2.8 to 3.2 cm long), its longer calyx lobes at anthesis (4 to 7 mm long vs. 2 to 3 mm), and its longer capsules (15 to 20 mm long). *Ruellia pittieri* is also easily confused with *R. tonduzii*, which differs in its shorter peduncles, (mostly less than 10 cm long), its oblong-elliptic bracts, and while the size ranges overlap, its generally shorter leaves (6 to 13.5 cm long vs. 7 to 19 cm).

**Ruellia praeclera** Standley, Publ. Field Columbian Mus., Bot. Ser. 4: 263. 1929. Figure 16.

Suffrutescent plants to 2 m tall; internodes between leaf-bearing nodes 2.4–4.5 cm long, 2.3–3.0 mm thick, quadrangular, appressed pilose. Leaves on petioles 1.5–3 cm long, glabrous to appressed pilose; laminae oblanceolate, 5.5–30 cm long, 1.6–9 cm broad, apically acuminate, basally acute to attenuate, margins entire to undulate, glabrous to sparingly strigose at the costa and veins, the cystoliths prominent on both surfaces. Flowers axillary, sessile, solitary to clusters of 3; bracts linear to linear-ob lanceolate, 18–30 mm long, 2–3 mm broad, sericeous plus glandular hairs. Calyx segments linear to linear-lanceolate, 9–35 mm long, 1.5–2 mm broad, sericeous with numerous glandular hairs; corolla white, 8–10 cm long, funnelform, puberulous-glandular, unexpanded portion 4–5.5 cm long, 3 mm broad, expanding to 9–14 mm broad at the mouth, lobes orbicular 15–20 mm in diameter; stamens included, but extending to just below the mouth. Fruits not seen.

Found in the shade of lowland rain forests of western Panama (Caribbean side) and one site in the Osa Peninsula of Costa Rica. Three flowering collections have been made, two in January by Burger & Liesner 7202 (F, NY), 7329 (F), and one in March by Burger & Gentry 8915 (US), all from near Rincón de Osa of Puntarenas Province. The Costa Rican population is at the lower range of measurements for leaves, bracts, and calyx lobes. Also, bracts and calyx lobes are linear-ob lanceo-

late and linear-lanceolate, respectively, in the Costa Rican population as opposed to linear for both in the Panamanian population.

*Ruellia praeclera* is recognized by its sessile, axillary, solitary flowers with white corollas (8 to 10 cm long), its large lanceolate leaves (to 30 cm long), and its linear to linear-lanceolate calyx lobes (9 to 35 mm long) with both sericeous and numerous smaller glandular hairs. It may be confused with *R. tubiflora* var. *tetrasitchantha* or var. *hirsuta*, both of which differ in their terminal and subterminal spicate inflorescences, the numerous glandular spots on the lower surfaces of leaves and bracts, and much shorter calyx lobes (3.5 to 4 mm long vs. 9 to 35 mm long).

**Ruellia stemonacanthoides** (Oerst.) Hemsl., Biol. Centralbl. 2: 507. 1882. *Arrhostoxylum stemonacanthoides* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 130. 1855. Figure 17.

Herbs to suffrutescent plants 1 m tall; internodes between leaf-bearing nodes, 3–10.5 cm long, 1.3–3.2 mm thick, quadrangular, puberulous. Leaves on petioles to 3.5 cm long, puberulous to glabrous; laminae ovate-elliptic, 4–12 cm long, 2–5.7 cm broad, apically acuminate, basally acute and often slightly attenuate, margins undulate, glabrous above, frequently drying to a purplish color, puberulous beneath on costa and veins, cystoliths dense and visible on both surfaces although occasionally obscure. Inflorescences in axillary panicles, often dichotomously branched, peduncles to 11 cm long, quadrangular, often slightly winged, glabrous; bracts elliptic, 10–27 mm long, 2–6 mm broad, glabrous. Flowers sessile to pedicels 3 mm long, puberulous, with calyx segments linear-subulate, 4–7 mm long at anthesis, 6–10.5 mm long at fructescence, sparingly puberulous; corolla pale violet, funnelform, 2.8–3.2 cm long, puberulous, unexpanded portion of tube 9–11 mm long, 1.1–1.5 mm broad, 10–12 mm broad at the mouth, lobes equal, obtuse, 6–9 mm long, 5–8 mm broad; stamens included. Fruits clavate, 15–20 mm long, 3–5 mm broad, 2.25–4.5 mm thick, sparingly puberulous; seeds 8–10, suborbicular, 2.5–3.2 mm in diameter.

This species is commonly found in or near recently cut forests or in new pastures in premontane forest areas of Costa Rica to Guatemala and western Mexico. In Costa Rica it has been collected mainly from the Pacific watershed areas of San José, Alajuela, and Guanacaste provinces, with one collection from the Guápiles area of Limón Province, all at elevations of 300 to 1000 m. Flowering collections have been made in September through November, January, February, April, and July.

*Ruellia stemonacanthoides* is recognized by its paniculate inflorescences which are often dichotomously branched on peduncles to 11 cm long, its pale violet corollas (2.8 to 3.2 cm long), its calyx lobes (4 to 7 mm long at anthesis), and its sparingly puberulous, clavate capsules (15 to 20 mm long). It is easily confused with *R. pittieri* and *R. tonduzii*. See the description of *R. pittieri* to distinguish these differences.

**Ruellia tonduzii** Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica 9: 188. 1898, and in Pitt., Prim. fl. costaric. 2: 203. 1900. Figure 17.

Erect herbs to ca. 50 cm tall; internodes between leaf-bearing nodes 2.5–7 cm long, 1.5–2.5 mm thick, quadrangular, slightly winged, glabrous. Leaves on petioles 2–3 cm long, puberulous; laminae elliptic to ovate, 3.5–12.5 cm long, 1.1–5.2 (7) cm broad, apically acuminate, basally acute and frequently attenuate or obtuse, margins undulate, glabrous above, puberulous on costa and veins beneath, cystoliths dense and prominent on both surfaces. Inflorescences in axillary, dichotomously branching panicles on glabrous, quadrangular, slightly winged peduncles 5–9.8 cm long; bracts elliptic-oblong, 8–13 mm long, 1.5–3 mm broad, glabrous. Flowers borne singly on glabrous pedicels to 3 mm long; calyx segments subulate, 2.7–4 mm long, 0.5 mm broad basally, glabrous to subglabrous; corolla lavender, funnelform, 2.2–2.8 cm long, puberulous, unexpanded portion of tube ca. 9 mm long, 1.5 mm broad, 7 mm broad at the mouth, lobes equal, obtuse, 5–7 mm long, 3.5–5.5 mm broad, stamens included. Fruits clavate, 12–15 mm long, 3–4 mm broad, 2.5 mm thick, sparingly puberulous; seeds 8, suborbicular, 2.4–2.6 mm in diameter.

This species is found in the shade of moist forest areas of the Pacific coastal regions of Panama and Costa Rica. In Costa Rica it has been collected in Puntarenas and San José provinces at elevations of 5 to 340 m. L. D. Gómez 2208 (F, MO, NY) was not included in this description because of the corolla color described as yellowish red and its location at 2100 m elevation in Heredia, although in other respects this specimen very closely resembles *R. tonduzii*. Flowering collections have been made from February through August.

*Ruellia tonduzii* is recognized by its axillary, dichotomously branching panicles on glabrous, quadrangular peduncles (ca. 5 to 9 cm long), flowers borne singly on short pedicels (to 3 mm long), elliptic-oblong bracts (8 to 13 mm long), calyx lobes (2.7 to 4 mm long), and capsules (12 to 15 mm long). It is easily confused with *R. pittieri* and *R. stemonacanthoides*. (See the description of *R. pittieri* to distinguish these differences.)

**Ruellia tubiflora** Kunth in H.B.K., Nov. gen. sp. 2: 241. 1817. Figure 17.

**Ruellia tubiflora** H.B.K. var. *tetrastichantha* (Lindau) Leonard, Contr. U.S. Natl. Herb. 31: 91. 1951. *R. tetrastichantha* Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica 2: 300. 1900. Fl. Costaricensis. 2: 300. 1900.

Suffrutescent plants to 3 m tall; internodes between leaf-bearing nodes 4.5–11 cm long, 2.5–4.5 mm thick, quadrangular, puberulous. Leaves on petioles to 5 cm long, puberulous; laminae elliptic, 10–23 cm long, 3.5–10 cm broad, apically acuminate, basally attenuate, margins undulate, glabrous above, puberulous on costa and veins to glabrous beneath, gland-dotted beneath, occasionally gland-dotted above, cystoliths visible above, obscure beneath. Inflorescences in compressed, short, terminal, and subterminal spikes with a rachis to 1.2 mm long; bracts, pale green to greenish white, leafy, elliptic, 4–5.5 cm long, 12–18 mm broad, gland-dotted; bracteoles small, subulate, ca. 2 mm long. Flowers sessile; calyx segments subulate, 3.5–4 mm long, 1 mm broad basally, puberulous; corolla white or yellow, funnelform, 7.5–9 cm long, puberulous, often gland-dotted, unexpanded portion of tube 3–3.5 cm long, 2.5–3.5 mm broad, expanded portion 15–23 mm broad at the mouth, lobes suborbicular, 9–15 mm long, 11–20 mm broad; stamens included. Fruits clavate, 2.2–3 cm long, 7.4–8 mm broad, 6 mm thick, glabrous to minutely puberulous; seeds 8–12, suborbicular, 4.5–5.5 mm in diameter.

Comparatively wide ranging, this species is found in shaded areas of wet forests or thickets at lower to middle elevations of Costa Rica, Panama, and Colombia. In Costa Rica it has been collected in Alajuela, Cartago, Limón, and Puntarenas provinces at elevations of 450 to 900 m. Flowering collections have been made in January through March.

*Ruellia tubiflora* var. *tetrastichantha* is recognized by its inflorescences of very short, terminal spikes (1.2 cm or less long), its white, funnelform corollas (7.5 to 9 cm long) which are often gland-dotted, its leaves which are gland-dotted beneath, and its pale green to greenish white bracts which are also gland-dotted. It most closely resembles *R. tubiflora* var. *tubiflora* and var. *hirsuta*. Variety *tubiflora* is distinguished by its red corolla, and var. *hirsuta*, by its subtomentose internodes in younger stems and its leaves with relatively long pilose hairs on both surfaces. It can also be confused with *R. paeclaris*, which differs in its axillary flowers, its calyx segments (1 to 3 cm long) with sericeous hairs combined with numerous shorter glandular hairs, and its puberulous glandular corolla.

**Ruellia tubiflora** H.B.K. var. **hirsuta** Leonard,  
Contr. U.S. Natl. Herb. 31: 93. 1951. Figure 17.

This variety resembles *R. tubiflora* var. *tetragastriana* most closely and differs mainly in its hairiness. Leafy internodes are subtomentose, and the leaves and bracts are pilose on both surfaces.

This variety is also found in central Colombia. Only one collection, *Allen* 6316 (F, MO), has been made in Costa Rica in the Esquinas Forest between Río Esquinas and Palmar at 30 m. The collector described it as very common in the forest. This flowering collection was made in late November.

### **Sanchezia Ruiz & Pavón**

REFERENCES—E. C. Leonard, Notes on the genus *Sanchezia*, J. Wash. Acad. Sci. 16: 484–492. 1926. E. C. Leonard and L. B. Smith, *Sanchezia* and related American Acanthaceae. Rhodora 66: 313–343. 1964.

Erect or climbing herbs or shrubs, mostly glabrous. Leaves petiolate; laminae with numerous cystoliths on both surfaces, glabrous. Flowers solitary or more often fascicled, those that are fascicled subtended by bracts which are often large, partly connate and showy; calyx 5-merous; corolla usually large and showy, corolla tube cylindric, the lobes 5 and equal; stamens 2, usually exserted, the anthers 2-celled, mucronulate basally, puberulous, staminodes 2. Fruit an oblong capsule, 6–8 seeds; seeds orbicular.

This genus contains about 59 species, all native to tropical America and found mainly in wet forest areas of the northern Andes with two exceptions: *S. pennellii* Leonard extends into the Darién Province of eastern Panama, and *S. parvibracteata* is found in Mexico and Central America, but probably escaped from cultivation.

**Sanchezia parvibracteata** Sprague & Hutchinson, Bull. Misc. Inform. 253. 1908.

Shrubs to 2.5 m tall, stems subquadangular, glabrous; internodes between leaf-bearing nodes, 4–6 cm long, 4–5.5 mm thick. Leaves with short, glabrous petioles to 3 cm long; laminae elliptic to obovate, 12–24 (35) cm long, 5–11 (15) cm broad, apically abruptly acuminate, basally attenuate, margins undulate-serrate, glabrous, costa and

veins edged in yellow, cystoliths numerous and prominent on both surfaces, ca. 0.5 mm long. Inflorescences in sparingly branched terminal panicles to 20 cm long; bracts loosely imbricate, ovate, 15–20 mm long, 7.5–10 mm broad, apically obtuse, glabrous; bracteoles oblong ovate, ca. 15 mm long, 4 mm broad, apically rounded, glabrous; peduncles to 5 cm long, glabrous; rachis glabrous. Flowers 3–5 per pair of bracts, sessile; calyx segments oblong, 2–2.5 cm long, 3.5–5 mm broad, apically obtuse, minutely puberulous at apex outside, glandular-puberulous inside; corolla red or ochre, puberulous with yellowish appressed hairs, 4–5 cm long, 6–7 mm broad at the throat, 5 mm broad just above ovary, lobes oblong, reflexed, 5–7 mm long, 5 mm broad; stamens exserted to 8 mm beyond the mouth of corolla, filaments sparsely villous, anthers 6–7 mm long; staminodes 15 mm long, sparingly pilose. Fruit not seen.

In Central America this species is usually found in gardens. It is probably native to the Northern Andes since collections have been made there (Leonard, 1951). Only one Costa Rican collection has been observed. This was a flowering collection from a thicket in the Monteverde area, altitude 1500 m, Puntarenas Province, *Palmer* 36769 (CR).

*Sanchezia parvibracteata* is recognized by its flowers in fascicles of three to five loosely enclosed by a bract, its large red or ochre, equally five-lobed corolla, and its exserted stamens with two-celled anthers which are basally spurred. It is not easily confused with other Acanthaceae from Costa Rica.

### **Spathacanthus Baillon**

Shrubs or small trees. Leaves petiolate; laminae usually large, oblong, or elliptic. Flowers large, few, borne on small terminal branches; bracts small; calyx spathaceous, valvate; corolla usually large, white, the tube salverform, the limb 5-lobed, bilabiate, the lobes subequal; stamens 4, didynamous; anther lobes parallel. Fruit a capsule, large, glabrous.

There are five species in this genus of Mexico and Central America. Because of the spathaceous, two-lobed calyx, this genus is not easily confused with other genera of the family.

**Spathacanthus hoffmannii** Lindau, Bull. Herb. Boissier 3: 370. 1895. Figure 17.

Shrubs or small trees to 8 m tall; internodes between leaf-bearing nodes 1.5–4.5 cm long, 2–3 mm thick, glabrous. Leaves subsessile to petioles 10 mm long, glabrous; laminae elliptic to elliptic-obovate, 7.5–27 cm

long, 3–7.5 cm broad, apically acuminate, basally long attenuate, margins undulate, glabrous on both surfaces, cystoliths dense and prominent on both surfaces. **Flowers** axillary, solitary, in clusters of 2 or 3 or in small racemes, peduncles to ca. 2 cm long, glabrous; pedicels 6–10 mm long, glabrous; **bracts** subulate, ca. 2 mm long, 1 mm broad basally, bracteoles similar but smaller. Flowers with a spathaceous calyx 2.2–3.5 cm long, glabrous, fused for ca. half its length and then separating into 2 mostly equal lobes that are apically acute and apiculate, lobes 8–12 mm broad; **corolla** white, 8–8.7 cm long, glabrous, ca. 2 mm broad basally, expanding to 13–15 mm broad at the mouth, the lobes subequal, obtuse, 12–15 mm long, 12–15 mm broad; **stamens** didynamous, included, anthers 2-celled, ca. 4.5 mm long, basally rounded. **Fruits** clavate, 7–8 cm long, 12–14 mm broad, ca. 11 mm thick, glabrous; seeds 4, flattened, suborbicular, 9–10 mm in diameter, 2–3 mm thick, surface dark brown, rugose.

This species is found in moist habitats at middle elevations in forest clearings most frequently along streams and rivers. I have seen no collections of it outside Costa Rica where it has been collected at elevations of 750 to 1750 m, mostly in the Caribbean watershed areas of Alajuela, Cartago, and Heredia provinces. One collection, *Standley & Valerio 44745* (F) is known from the Pacific watershed, Tilarán area, Guanacaste. Flowering collections have been made in July through October and in January (the Guanacaste collection).

*Spathacanthus hoffmannii* is recognized by its woody habit, its large elliptic to elliptic-obovate leaves, its large, showy, white flowers with a five equally lobed corolla, two large, lobed spathaceous calyx and strongly didynamous stamens with two-celled anthers which are rounded basally, and its large, clavate fruit. With this combination of characters, it is not easily confused with other Acanthaceae.

### Streblacanthus Kuntze

**Herbs** to suffrutescent plants. **Leaves** petiolate. **Inflorescences** of lax terminal and axillary spikes; bracts narrowly oblong to filiform, long and conspicuous. **Flowers** with a 4-merous calyx, segments narrow and equal; **corolla** tube expanded basally, narrowed to a slender throat, the limb bilabiate, spreading, the upper lip 2-lobed, the lower lip 3-lobed; **stamens** 2, exserted, the filaments short, attached to the throat of the corolla, anthers 2-celled, the cells unequal and widely separated, 1 usually fertile, calcarate basally, the other much smaller, rounded basally and often abortive; staminodes absent. **Fruit** a slender clavate capsule; seeds 2–4.

This is a genus of four species with one species each described from Mexico, Guatemala, Costa Rica, and Bolivia.

### Streblacanthus monospermus Kuntze, Revis. gen.

pl. 2: 498. 1891. *Streblacanthus macrophyllus* Lindau, Anales Inst. Fis.-Geogr. Nac. Costa Rica 9: 188. 1898, and in Pitt., Prim. fl. costaric. 2: 306. 1900. *Streblacanthus longiflorus* Cufodonitis, Arch. Bot. (Forli). 10: 48. 1934. Figure 17.

**Herbs** to 1 m tall; **internodes** between leaf-bearing nodes 3–5.5 cm long, 3–5.5 mm thick, tetragonal, puberulous along 2 lines in younger portions to glabrous in older. **Leaves** on petioles to 2.2 cm long, puberulence of petioles that of the stem; laminae elliptic, 6–19 cm long, 2.5–8 cm broad, apically acuminate, basally acute, margins entire to sparingly crenulate, glabrous to sparingly strigose on both surfaces, cystoliths visible on both surfaces. **Inflorescences** in terminal and axillary spikes, to 25 cm long, peduncle to 2.5 cm long, brownish pilose; rachis brownish pilose-glandular; **bracts** narrowly elliptic to oblong, 13.5–20 mm long, 3–4 mm broad, densely pilose-glandular; bracteoles long-subulate, 6–10 mm long, 1–2 mm broad basally, pilose-glandular. **Flowers** with 4-merous calyx, lobes subulate, 4–4.5 mm long, 0.8–1 mm broad basally, pilose-glandular; **corolla** lavender or white, salverform, puberulous, the tube 2–3 cm long, 1.5 mm broad expanding to 3 mm broad around the ovary, lobes of the upper lip obovate, 9–10 mm long, 7–8 mm broad, apically acute, lower lip very similar, lobes ca. 5 mm broad; **stamens** exserted just beyond the mouth with a tuft of pilose hairs at the apex of each filament; anther cells unequal and widely separated, the upper cell 1 mm long, basally calcarate, the lower 0.5 mm long and producing pollen. **Fruits** clavate, long-stipitate, 2–2.5 cm long, 5.5–7 mm broad, ca. 2 mm thick, pilose-glandular; seeds 4, orbicular, 5–6 mm in diameter.

This species is apparently endemic to Costa Rica where it is found in lowland rain forests of the Caribbean coastal region. Flowering collections have been made in March, May, and September. Since the type collection was made at the Río Yor-kín at the Panamanian border, this plant should also be found in adjacent Panama.

*Streblacanthus monospermus* is recognized by its white to lavender salverform corollas with two exserted stamens on very short filaments and widely separated anther cells, the upper cell calcarate and the lower cell much smaller and lacking a spur. After examining the types of *S. monospermus*, Kuntze s.n. (US) and *S. macrophyllus*, Lindau 8547 (US), I have concluded that these are the same species. The only difference between them is in the length of the corolla lobes, and more

recent collections of *S. monospermus* show that the original measurements were made from immature corollas.

### Teliostachya Nees

REFERENCES—C. G. Nees von Esenbeck, Acanthaceae. In DC., Prodr. 11: 262–264. 1847. C. E. B. Bremekamp, Notes on the Acanthaceae of Surinam. Recueil Trav. Bot. Néerl. 35: 149. 1938.

**Herbs**, ascending or decumbent. Leaves petiolate; laminae ovate to lanceolate with numerous cylindrical cystoliths, the margins entire. Inflorescences in dense spikes either terminal or terminal and axillary, the spikes either cylindrical or ovoid; pedicels arranged in whorls of 3–7, the lateral flowers of each whorl subtended by a 1- to 3-nerved bract; 2 bracteoles subtending the lateral flowers, 1-nerved. Flowers with a 5-merous calyx, segments unequal, divided nearly to the base, the posterior lobe much larger than the rest, 3-nerved, the lateral lobes 1-nerved, the anterior lobes 1- or 2-nerved, longer than the lateral nerves; corolla about as long as the calyx, the tube cylindric, 2-lipped, the upper lip obtuse, emarginate or subentire, the lower lip 3-lobed, the lateral lobes obtuse, the middle lobe emarginate or obtuse; stamens 4, didynamous, the anthers 2-celled, unequal, the lower cell and sometimes both basally apiculate; stigma 2-lobed, the style curved toward the upper lip.

This is a genus of about 10 species occurring throughout much of tropical America and in West Africa. Only one species occurs in Central America. It closely resembles *Lepidagathis*, a genus endemic to the Old World. According to Bremekamp, *Teliostachya* differs in its definitely terminal spikes, calyx segments which are almost entirely free as opposed to at least partially united segments, its unequal anther cells as opposed to equal cells, and its pollen grains which are entirely free from reticulations as opposed to the finely reticulate grains of *Lepidagathis*.

**Teliostachya alopecuroides** (Vahl) Nees in Mart., Fl. bras. 9: 72. 1847. *Ruellia alopecuroides* Vahl, Eclogae americanae 2: 49. 1798. *Lepidagathis alopecuroides* (Vahl) R. Br. ex Griseb., Fl. Brit. W.I. 453. 1864. Figure 18.

**Herbs** to 25 cm tall; internodes between leaf-bearing nodes 2–5.5 cm long, 1–1.5 mm thick, quadrangular, puberulous mostly at the angles. Leaves on puberulous petioles to 1 cm long; laminae ovate to ovate-elliptic,

2.5–8 cm long, 1.5–3.2 cm broad, apically acute to slightly acuminate, basally attenuate, margins entire, glabrous above, strigose mostly on costa and veins beneath, cystoliths dense on both surfaces. Inflorescences in dense terminal or axillary cylindrical spikes to 5 cm long, 1.3 cm broad; flowers in sessile whorls of 3–5; 1 bract subtending each flower, obovate lanceolate, 5–6 mm long, 1.5–2.2 mm broad, apically caudate, basally acute, thin, translucent, veins prominent, 3-nerved, transparent when wet, the margins ciliate, bracteoles 2, lanceolate linear, ca. 5 mm long, 0.4 mm broad, translucent with prominent veins, 1-nerved, ciliate. Flowers with a 5-merous calyx, segments unequal, the posterior pair oblanceolate, 4–5.5 mm long, the remaining segments lanceolate, 3–6 mm long, all venose, ciliate; corolla white to violet, tubular, 3.5–4 mm long, glabrous, 2-lipped, upper lip ca. 2.5 mm long, 1 mm broad, bidentate, lower lip 2.5 mm long, 3-lobed, lobes ca. 1 mm long; stamens exerted. Fruits oblong, 3.3–3.7 mm long, 1–1.1 mm broad, 0.8–1 mm thick, apically acuminate, basally acute, seeds 4, near ovate, flattened ca. 1 mm long, 8 mm broad, basally oblique, pilose when dry, hairs densely mucilaginous when wet.

This species occurs in moist areas along streams and trails in rain forests, in thickets, and in open fields. Its range includes most of South America, Central America, and the West Indies. Only one Costa Rican collection has been seen: Weston et al. 4292 (US) from near Repunta, 15 km south of San Isidro, San José Province, altitude 600 m. This flowering collection was made in January. Collections from neighboring countries have been made from near sea level to 1400 m elevation.

*Teliostachya alopecuroides* is a short, small-leaved herb that is recognized by its dense, terminal spikes with flowers containing a five-merous calyx with very dissimilar segments, the posterior and anterior segments longer and broader than the lateral segments, and its inconspicuous two-lipped corolla with four didynamous anthers which are two-celled and cells superposed. It is not easily confused with other species of Acanthaceae.

### Tetramerium Nees

REFERENCE—G. B. Happ, Monograph of *Tetramerium* and *Henrya*. Ann. Missouri Bot. Gard. 24: 501–582. 1937.

**Herbs** to suffrutescent plants; stems erect or declining, much-branched, pubescence often arranged in two opposite lines, the old bark often exfoliating. Leaves sessile or petiolate; laminae linear to ovate, glabrous or pubescent. Inflorescences in terminal and axillary 4-sided

spikes; bracts opposite, 4-ranked, conspicuous, often closely imbricate with mucronate apex; pedicels 1–3 per bract. **Flowers** with a 4–5-merous calyx of equal, ciliate segments; corollas funnelliform to tubular, bilabiate, the upper lip entire, the lower lip 3-lobed, the lobes ca. equal; stamens 2, included in the upper lip, the anthers 2-celled, cells slightly unequal. **Fruits** clavate, apiculate, 4- or 2-seeded; seeds flattened, tuberculate, or muriculate.

Twenty-three species have been recognized for this genus, and they range from the southern United States to Colombia and Ecuador.

**Tetramerium nervosum** Nees in Benth., Bot. voy. Sulphur 148, pl. 48. 1844. *T. hispidum* Nees in DC., Prodr. 11: 468. 1847. Figure 18.

Repent to upright herbs to ca. 30 cm tall; internodes between leaf-bearing nodes 2.5–6.5 cm long, 1.25–1.5 mm thick, terete, sparingly pilose. Leaves on pilose petioles to 15 mm long; laminae ovate, 2–7 cm long, 0.8–3 cm broad, apically acute to acuminate, basally rounded to acute, margins entire, sparingly strigose on both surfaces, numerous cystoliths visible on both surfaces. Inflorescences in terminal and axillary spikes to 7.5 cm long, 1.5 cm broad; bracts clearly 4-ranked, imbricate, ovate to elliptic, 7–11 mm long, 3.5–7 mm broad, apically mucronate, typically curved outward, basally obtuse, mostly 5-nerved, puberulous plus longer pilose hairs, ciliate; bracteoles narrowly lanceolate, 4–6.5 mm long, ca. 1 mm broad, ciliolate; peduncle 1–4 mm long, puberulous. **Flowers** with 4-merous calyx, calyx segments subulate, 3–3.5 mm long, ca. 0.5 mm broad, ciliolate; corolla white or slightly yellowish, bilabiate, 16–17 mm long, the tube narrowly funnelliform, 6.5–7.5 mm long, ca. 1.25 mm broad at the throat, 1 mm broad basally; the upper lip of one lobe, the lower lip 3-lobed, all lobes oblanceolate, 7–9 mm long, 2.5–3.5 mm broad, the lobes of lower lip at the narrower range; stamens exserted to ca. the length of the upper lip, attached to base of middle lobe of lower lip, cells of the anthers slightly unequal, ca. 1.5 mm long, gray or bluish. **Fruit** clavate, 5–6 mm long, 2.25–2.5 mm broad, 1.75–2.25 mm thick, puberulous; seeds 4, rhomboid, 1.75–2 mm long, 1.5–1.75 mm broad, surface tuberculate.

This species is found in secondary growth pastures, along roadsides and trails throughout tropical America, and extends into the southwestern

United States. In Costa Rica it is found from near sea level to 500 m elevation. It has been collected from Guanacaste and the Pacific Coastal area of Alajuela. Because this is a weedy species and omitted in collecting, it is of much more common occurrence in Costa Rica than these collections would suggest. Flowering collections have been made from December through March.

**Tetramerium nervosum** is recognized by its dense, terminal and axillary spikes with commonly outcurving, imbricate, mucronate bracts that are clearly four-ranked, its bilabiate, four-parted white or yellowish corollas with the two exserted stamens attached at the base of the middle lobe of the lower lip, and its two-celled anthers that are gray or bluish. It is sometimes confused with *Blechum brownei*, but can be distinguished from it by its four-merous calyx and corolla (vs. five-merous) and its two stamens (vs. four that are didynamous).

### Thunbergia Retz.

REFERENCE—C. E. B. Bremekamp, Delimitation and subdivision of the Acanthaceae, Bull. Bot. Surv. India 7: 21–30. 1965.

Herbaceous to suffrutescent vines or shrubs. Leaves petiolate with hastate, rhomboid, or ovate laminae, cystoliths absent. **Flowers** large, peduncled, solitary in the axils or in terminal or axillary racemes; bracts 2, foliaceous, large; calyx short, cupuliform, truncate, or toothed; corolla 5-merous; stamens 4, didynamous, attached near the base of the corolla tube, anthers 2-celled with an apiculate connective; ovary fleshy, the style, apically dilated; ovary subtended by a conspicuous, fleshy nectary. **Fruit** a 2-chambered capsule with a globose base extending abruptly into a flattened beak; seeds 2 in each locule, borne on papilliform funicles, semiglobose to ovoid, ventral side conspicuously excavated.

This is a genus of about 200 species mainly, if not exclusively, from tropical Africa and Asia.

### Key to Species of *Thunbergia*

- 1a. Petioles winged; corollas orange or yellow, often with a dark purple throat (rarely white) *T. alata*
- 1b. Petioles not winged; corollas blue, scarlet, white, or yellow ..... 2a
- 2a. Flowers solitary in the leaf axils; calyx reduced to 10–20 teeth ..... 3a
- 2b. Flowers in terminal or axillary racemes; calyx reduced to a basal ring or annulus ..... 4a
- 3a. Erect shrub; laminae basally acute ..... *T. erecta*

- 3b. Vine; laminae basally hastate to cordate ..... *T. fragrans*  
 4a. Corolla with blue lobes, yellowish or white throat; bracts irregularly oblong, 3–3.5 cm long ..... *T. grandiflora*  
 4b. Corolla scarlet, tube yellow; bracts ovate, 2–2.5 cm long ..... *T. mysorensis*

***Thunbergia alata*** Bojer ex Sims, Bot. Mag. 52: pl. 2591. 1825. Figure 18.

Herbaceous trailing or climbing vine; internodes between leaf-bearing nodes 4.5–13 cm long, 1–1.25 mm thick, strigose. Leaves with petioles to 6.5 cm long, petioles winged ca. 1 mm broad on each side, hirsute; laminae deltoid to deltoid-ovate, 3.5–7.5 cm long, 2.5 cm broad, apically acute, basally hastate to cordate, margins undulate, sparingly to moderately hirsute on both surfaces. Flowers axillary and solitary, peduncles to 8.5 cm long, hirsute; bracts 2 per flower, deltoid-ovate, 18–20 mm long, 9–10 mm broad, apically acute hirsute; calyx toothed with ca. 15–17 subulate lobes ca. 2 mm long, glandular-puberulous; corolla yellow or orange with dark purple throat; salverform, ca. 4 cm long, tube 2 cm long, lobes 5, ca. 2 cm long, apically emarginate. Fruits densely puberulous, 16–18 mm long, base ca. 7 mm in diameter, beak ca. 11 mm long, 5 mm broad, 2 mm thick; seeds 4, ca. 3.5 mm in diameter, honeycombed.

This species is native to eastern Africa and is widely cultivated in tropical America. It frequently escapes from cultivation and is found in fields and along trails and the edges of thickets. In Costa Rica it has been collected from near sea level to about 1000 m elevation. Flowering collections have been made from November through March and in July.

*Thunbergia alata* is recognized by its herbaceous, viny habit, its deltoid to deltoid-ovate laminae with winged petioles, and its yellow or orange salverform corolla with five equal emarginate lobes and a dark purple throat. It is most easily distinguished from other species of the genus by its leaves with winged petioles. There is a variety with white corollas and another with a white throat and orange lobes, but I have seen no collections of these from Costa Rica. *Thunbergia alata* most closely resembles *T. fragrans*, which has similar though white corollas and lacks winged petioles.

***Thunbergia erecta*** (Benth.) T. Anderson, J. Linn. Soc., Bot. 7: 18. 1864. *Meyenia erecta* Benth., Niger. Fl. 476. 1849.

Shrub to 3 m tall; internodes between leaf-bearing nodes 2.5–6.5 cm long, 1.25–2.5 mm thick, quadran-

gular, glabrous. Leaves with glabrous petioles to ca. 5 mm long; laminae elliptic, 1.5–6.5 (8.5) cm long, 0.8–2.6 (4.3) cm broad, apically acute, basally acute, margins undulate, glabrous to subglabrous on both surfaces. Flowers solitary in leaf axils, peduncles to 2.8 cm long, glabrous; bracts oblong-ovate, 10–20 mm long, 5–8 mm broad, apically acute, basally obtuse, glabrous to minutely puberulous at the apex. Flowers with the calyx reduced to 10–16 subulate teeth ca. 3 mm long, glandular-puberulous; corolla all white or deep violet lobes with a yellowish throat, broadly salverform, glabrous, 6–8 cm long, 6–8 mm broad basally constricting to 2–3 mm broad just above the ovary, expanding to 15–20 mm broad at the throat, lobes suborbicular, 15–25 mm in diameter; cells of the anther unequal, the base and margins of the anther cells puberulous. Fruit not observed.

This species is a native of tropical West Africa, but is widely cultivated. It has become naturalized from cultivation in many tropical areas, but all Costa Rican collections I have observed were from cultivation. These were from near sea level in Limón Province and from about 1000 m elevation from San José. Flowering collections were made in June and November.

*Thunbergia erecta* is recognized by its shrubby habit and its all white or violet, lobed, yellow-throated corollas from 6 to 8 cm long. The all white corolla may be confused with that of *T. fragrans*, and the violet, yellow-throated corolla may be confused with that of *T. grandiflora*, but both of these species have a viny habit and shorter corollas.

***Thunbergia fragrans*** Roxb., Pl. Coromandel 1: 47. 1795.

An herbaceous to somewhat woody vine; internodes between leaf-bearing nodes 3–11.5 cm long, 1–2 mm thick, quadrangular, strigose. Leaves with strigose petioles to 2.5 cm long; laminae ovate to ovate lanceolate, 5–11.5 cm long, 2–6.5 cm broad, apically acute, basally hastate to cordate, margins entire to slightly undulate, strigose on both surfaces. Flowers solitary in the leaf axils, pedicels to 8 cm long, strigose; bracts deltoid ovate, 1.3–2 cm long, 5–8 mm broad, apically acute, strigose. Flowers with a calyx of 12–20 teeth, the teeth ca. 3 mm long, puberulous; corolla white, salverform, pilose, the tube 2–2.5 cm long, 3–5 mm broad, the lobes cuneate,

nearly as long as the tube, crenate; anther cells ca. 3 mm long, basally acute. **Fruit** ca. 2.5 cm long, the beak subulate, flattened, 1–1.5 cm long.

A native of India, this species is rather widely cultivated, as it is in Costa Rica. Collections from cultivation have been made from near sea level to about 1000 m elevation. Flowering collections were made in October, February, April, and June.

*Thunbergia fragrans* is recognized by its twining habit and solitary flowers with a toothed calyx and a white corolla. It most closely resembles *T. alata*, which differs in its winged petioles and yellow corollas with a dark purplish throat.

**Thunbergia grandiflora Roxb., Hort. bengal. 45.  
1814.**

Suffrutescent climbing or twining vine; internodes between leaf-bearing nodes 6–19 cm long, 2.6–3.2 mm thick, subquadangular, glabrous. Leaves on scabrous petioles to 6 cm long, laminae ovate to ovate-hastate, 8–16 cm long, 3–13.5 cm broad, apically acuminate, basally hastate or rounded, margins often coarsely toothed or lobed below the middle, scabrous mostly on costa and veins on both surfaces. Inflorescences of elongated terminal and axillary racemes with 2–4 flowers at each node; peduncles to 4.5 cm long, quadrangular, glabrous to sparingly scabrous; pedicels to 3.3 cm long, sparingly scabrous; bracts irregularly oblong, 3–3.5 cm long, 17–20 mm broad, apically acute, sparingly puberulous plus numerous dark glandular appearing dots. Flowers with a very much reduced annular calyx at the base of the corolla, margin of annulus puberulent; corolla light or dark blue with a white or yellowish throat, campanulate, the tube 3.0–4.5 cm long, lobes 3–4 cm long, bases of the anther cells of the posterior stamens each with spurs to 3 mm long, only 1 anther cell spurred on each of the anterior stamens. **Fruit** base ca. 16 mm in diameter, beak flattened, ca. 2 cm long.

This species is native to Bangladesh and is widely cultivated in tropical regions of the world. Only collections from cultivation have been made in Costa Rica in the Central Valley area from Alajuela, Heredia, and San José provinces. Flowering collections were made in September and March.

*Thunbergia grandiflora* is recognized by its twining habit, its loose terminal and axillary racemes, its annular calyx, and its large, showy, campanulate corolla with blue lobes and a white or yellowish throat. It is not easily confused with other cultivated species of *Thunbergia*.

**Thunbergia mysorensis (Wight) T. Anderson ex  
Bedd. in Trans. Linn. Soc. London 25. 222: 1865.**

*Hexacentris mysorensis* Wight, Pl. asiat. rar. III: 78. t. 871. 1832.

A woody vine; internodes between leaf-bearing nodes 2–8.5 cm long, 1–1.5 mm thick, subquadangular, glabrous. Leaves with glabrous petioles to 1.6 cm long; laminae lanceolate-oblong, 5–9.5 cm long, 1.2–2.3 cm broad, apically attenuate, basally obtuse to subcordate, margins undulate, mostly 3-nerved, glabrous on both surfaces. Inflorescences in terminal and axillary racemes; peduncles to 6 cm long, glabrous; pedicels to 2.5 cm long, glabrous; bracts red, ovate, 2–2.5 cm long, 8–10 mm broad, apically acute, glabrous. Flowers with a very much reduced annular calyx at the base of the corolla; corolla zygomorphic, lobes scarlet, tube yellow, 5–5.5 cm long, throat opening obliquely with lower lobes reflexed and 2 upper lobes fused most of their length to partially enclose the stamens and style, stamens with anthers ca. 8 mm long, basally long-spurred, spurs ca. 4 mm long. Fruits not observed.

Native to India, this species is occasionally cultivated in Costa Rica for its showy inflorescences. I have observed only two Costa Rican collections, Jiménez 447 (F) and Sánchez 4 (F). Both were in flower, one collected in January, the other in March.

*Thunbergia mysorensis* is recognized by its lanceolate-oblong leaves with obtuse to subcordate bases, its showy flowers in terminal or axillary racemes with red bracts, its annular calyx, and its zygomorphic corollas with scarlet lobes and yellow tubes. It is not easily confused with other *Thunbergia* species grown in Costa Rica.

**Trichanthera H.B.K.**

**Shrubs or trees.** Leaves petiolate; laminae ovate to oblong, entire to undulate, numerous cystoliths visible on the upper surface of dried specimens. Inflorescences in compact terminal panicles (or corymbs). Flowers subtended by 2 small, triangular bracteoles; calyx 5-merous with sepals separate, equal and mostly obtuse; corolla regular, 5-lobed, tomentose, campanulate; stamens 4, exserted, didynamous, the anthers ciliate, with 2 equal basally rounded cells. **Fruit** a 2-chambered capsule with 2 seeds per locule.

*Trichanthera* is a genus of two species ranging from Central America to Brazil. It is most easily confused with the genus *Bravaisia*, but can be distinguished from it by its basally rounded anthers (vs. spurred) and one- to four-seeded capsules (vs. eight-seeded).

**Trichanthera gigantea (Humb. & Bonpl.) Nees in  
DC., Prodr. 11: 218. 1809. *Ruellia gigantea***

Humb. & Bonpl., Pl. aequinoct. 2: 75, pl. 102.  
1809.

REFERENCE—T. B. Croat, Flora of Barro Colorado Island, p. 790. Stanford Univ. Press. 1978.

**Shrubs** or small **trees** to 10 (17) m tall; **internodes** between leaf-bearing nodes 4–6 mm thick, tetrangular, brown tomentose. **Leaves** with petioles 1.5–6 cm long; laminae ovate to elliptic, 10–26 cm long, 6–10 cm broad, apically acuminate to acute, basally acute to obtuse or oblique, margins entire to slightly undulate, the surfaces glabrous except sparingly pilose on the costa of larger leaves. **Inflorescences** in terminal, compact panicles tending to be secund, to 15 cm long, 6 cm broad, branches light brown tomentose. **Flowers** subtended by 2 triangular bracteoles to 3 mm long; sepals 10–12 mm long, tomentose, apically rounded to acute; corollas shiny yellow in the throat, brownish red in the expanded portion, 3–4 cm long, glabrous at throat, silky tomentose above, silky tomentose outside, the tube 1–1.5 cm long, the limb 2–3 cm across; lobes 4–6 mm broad, oblong to oblong-ovate; ovary brown tomentose, style 4–5 cm long. **Fruits** 1.5–2 cm long, 5 mm broad, apically obtuse, sericeous; seeds flattened, lenticular, 3–4 mm in diameter.

This is a wide-ranging species of moist lowland forests, frequently along streams and swampy areas. While it is not abundant in areas where collected, it extends from Costa Rica through Colombia and Venezuela to the mouth of the Amazon in Brazil. Although *T. gigantea* occurs in Costa Rica (Leonard, 1938), this description is based upon Panamanian collections. On Barro Colorado Island, Panama, Croat has observed flowering from January to April, especially in February and March.

*Trichanthera gigantea* is recognized by its arborescent habit; paniculate inflorescences with tomentose sepals and corolla; more or less equally five-lobed corollas 3 to 4 cm long; didynamous stamens with two-celled anthers that are basally rounded; sericeous capsules with one to four seeds. It may be confused with *Bravaisia integerrima*, which differs in its basally spurred anthers and glabrous capsules that are eight-seeded.

## PLANTAGINACEAE

By William Burger

**Herbs** (rarely subshrubs with few-branched woody stems in island endemic species of *Plantago*), annual or perennial, stems usually very short above the ground with closely congested internodes, xylem in discrete bundles or forming a cylinder, a rhizome often present; stip-

ules absent. **Leaves** alternate (rarely opposite), simple and usually from basal rosettes, petioles often not strongly differentiated from the lamina, leaf-base clasping the stem; laminae linear to broadly ovate, entire or with small lobes or teeth, glabrous or puberulent, venation palmate or parallel. **Inflorescences** solitary from each leaf axil, **flowers** usually in dense spikes or capitula on a long, unbranched peduncle, each flower subtended by a single bract. Flowers small and sessile or subsessile, bisexual (in ours) or unisexual, radially symmetrical and usually 4-parted (rarely 3-parted); sepals 4 (3), free or partly united, imbricate in bud; petals united to form a short tube, the 4 (3) corolla-lobes spreading or reflexed at anthesis, membranous to scarious, white to yellowish, often persisting; stamens as many as the corolla-lobes and alternate with them (1 or 2 in *Bougueria*), filaments borne on the corolla-tube and inflexed in bud, anthers exserted and versatile, 2-thealous, introrse and longitudinally dehiscent, pollen 4–20-porate; pistil 1, ovary superior, usually 2-(3, 4)-locular in *Plantago* with 1 to many ovules in each locule, 1-locular with a single basal ovule in *Bougueria* and *Littorella*, style 1, stigma 1- or 2-lobed. **Fruit** a thin-walled capsule opening at or below the middle circumscissily (a pyxis) in *Plantago*, a small nut in *Bougueria* and *Littorella*; seeds often lustrous, endosperm present (absent in *Littorella*), embryo straight (curved in *Bougueria*).

A family of three genera and about 250 species in temperate, arctic, and montane habitats. *Bougueria nubicola* is found in the high Andes of southern South America. *Littorella* is a genus of semiaquatic, freshwater habitats, with one species in Europe, one in North America, and a third species in southern South America. *Plantago* is cosmopolitan in cooler or montane habitats and the only genus found in Central America. While its close relationships are obscure, the tubular corolla and bilocular ovary with axile placentation (in *Plantago*) has suggested an affinity with the Scrophulariales.

## *Plantago* Linnaeus

**Herbs** (in ours) or **subshrubs**, annual or perennials, usually scapose plants with very short stems, clustered basal leaves and erect, unbranched peduncles bearing small, congested flowers. **Leaves** all basal and rosulate in Central American species, alternate and tightly congested (in ours), petioles present or absent, poorly differentiated from the lamina, clasping the stem at their base; laminae linear to broadly ovate, glabrous or more often puberulent, entire or with short blunt lobes or teeth, venation palmate or parallel. **Inflorescences** spicate or capitate with long, erect, unbranched peduncles, flowers sessile in the axils of bracts. **Flowers** small and bisexual, sessile in the axils of bracts, sepals 4, free or partly united, often unequal with 2 longer and 2 shorter, imbricate in bud, margins scarious, petals united to form a short tube,

the 4 lobes reflexed or spreading at anthesis, persistent and sometimes forming a cover over the fruit; stamens 4 or 2, exserted at anthesis; ovary 2-locular or 3- or 4-locular by intrusion of the placentae, ovules 1 to several in each locule. Fruit a thin-walled capsule with circumscissile dehiscence around the middle; endosperm present, embryo straight.

A genus of worldwide range but restricted to temperate, arctic, and montane environments; absent in the lowland tropics except on islands. A number of island endemics have unusual woody growth forms, but most species have a very short aerial stem, leaves arising from near the ground

and erect scapose inflorescences. These plants can be mistaken for sedges and other monocotyledons because of the often narrow leaves with parallel venation and the small, tightly clustered flowers subtended by brownish bracts. The small flowers with short corolla-tube, four scarious corolla-lobes, long, slender filaments, exserted versatile stamens, and fruit with circumscissile dehiscence easily distinguish these plants. Dr. Knud Rahn has revised many New World species (see *Nordic Journal of Botany* 3: 331-342, 1983, and included references).

#### Key to Species of *Plantago*

- 1a. Leaves becoming broadly ovate, lamina abruptly narrowed at the base (in larger leaves); corolla-lobes 0.5-1 mm long; ovary with many ovules, seeds usually more than 8 ..... *P. major*
- 1b. Leaves elliptic to oblanceolate, laminae tapering gradually at the base to join the poorly differentiated petiole; corolla-lobes 2-3 mm long; ovary with 6 or fewer ovules, seeds fewer than 7 ..... 2a
- 2a. Corolla-lobes persisting and erect in fruit, forming a pointed "cap" at the apex of the fruit; ovary with 3-6 ovules, seeds 1-6; native and common ..... *P. australis*
- 2b. Corolla-lobes not persisting as a cap above the fruit; ovary with 2 ovules; seeds 1 or 2; introduced, rare ..... *P. lanceolata*

**Plantago australis** Lamarck, Encycl. Meth. Bot. Illust. Gen. 1: 339. 1793. *P. hirtella* H.B.K., Nov. gen. sp. 2: 187 or 229, t. 127. 1817. *P. hartwegii* Decne. in DC., Prodr. 13, pt. 1: 724. 1852. *P. schiedeana* Decne. in DC., loc. cit. 723. *P. sodiroana* Pilger, Bot. Jahrb. Syst. 25: 733. 1898. *P. ecuadorensis* Pilger, loc. cit. 50: 232. 1913. *P. australis* ssp. *hirtella* (H.B.K.) Rahn, Bot. Tidsskr. 60: 50. 1964. Figure 19.

Herbs, perennial, stems very short above the ground, internodes congested and obscured by the leaf-bases. Leaves usually in basal rosettes, quite variable in size on different plants, petioles to 15 cm long; laminae 4-25 (35) cm long 0.5-5 (7) cm broad, lanceolate to oblanceolate or narrowly elliptic-obovate, obtuse to acute at the apex, gradually narrowed to the base and continuous with the petiole, margin entire or slightly undulate, very sparsely (rarely glabrous) to densely puberulent on both surfaces with slender septate and translucent hairs 0.5-1.5 mm long, drying thin-chartaceous and greenish, venation parallel with (3) 5 or 7 primary veins. Inflorescences 3-50 (100) cm long, peduncle sparsely to densely whitish villous with hairs to 2 mm long, flowering portion 3-50 cm long, flowers usually congested near the apex, more separate near the base, bracts 1.6-4.2 mm long, 0.6-1.4 mm wide, triangular to ovate, usually ciliate along the margin. Flowers with sepals 1.7-2.7 mm long, ca. 1 mm broad, 1 often longer than the other 3, usually puberulent along the keel and ciliate along the margin distally, corolla-lobes 2-3.5 mm long, narrowly ovate, usually erect and spread apart only at anthesis,

persistent and becoming stiff in fruit; anthers 1.2-1.6 mm long; ovary usually with 3 ovules. Fruit 2-4 mm long, to 6 mm together with the persisting beaklike imbricate corolla-lobes, pale brown; seeds 1.2-2.4 mm long, ca. 1 mm broad, oblong, flat and with a small circular scar on the inner face, pale brown, smooth.

Plants of open, sunny sites in regions of wet, evergreen, montane forest formations between 1500 and 3200 m elevation in Costa Rica; to as low as 400 m in northern Central America. Inflorescences are produced throughout the year, but there may be a flowering peak in August. The species ranges from Arizona and Mexico through the Central Highlands of Central America and western Panama through the highlands of northern and central South America to Bolivia, Brazil, and Argentina.

*Plantago australis* is our only native species of *Plantago* and can be recognized by the stiff, erect corolla-lobes that are persistent and form a "beak" on the apex of the fruit. The corolla-lobes appear to be open for a very short period during anthesis and are otherwise erect and imbricate. As with other species, the name *Llantén* is commonly used for these plants. Rahn distinguishes a number of subspecies; most of our material would appear to belong to ssp. *hirtella* (H.B.K.) Rahn.

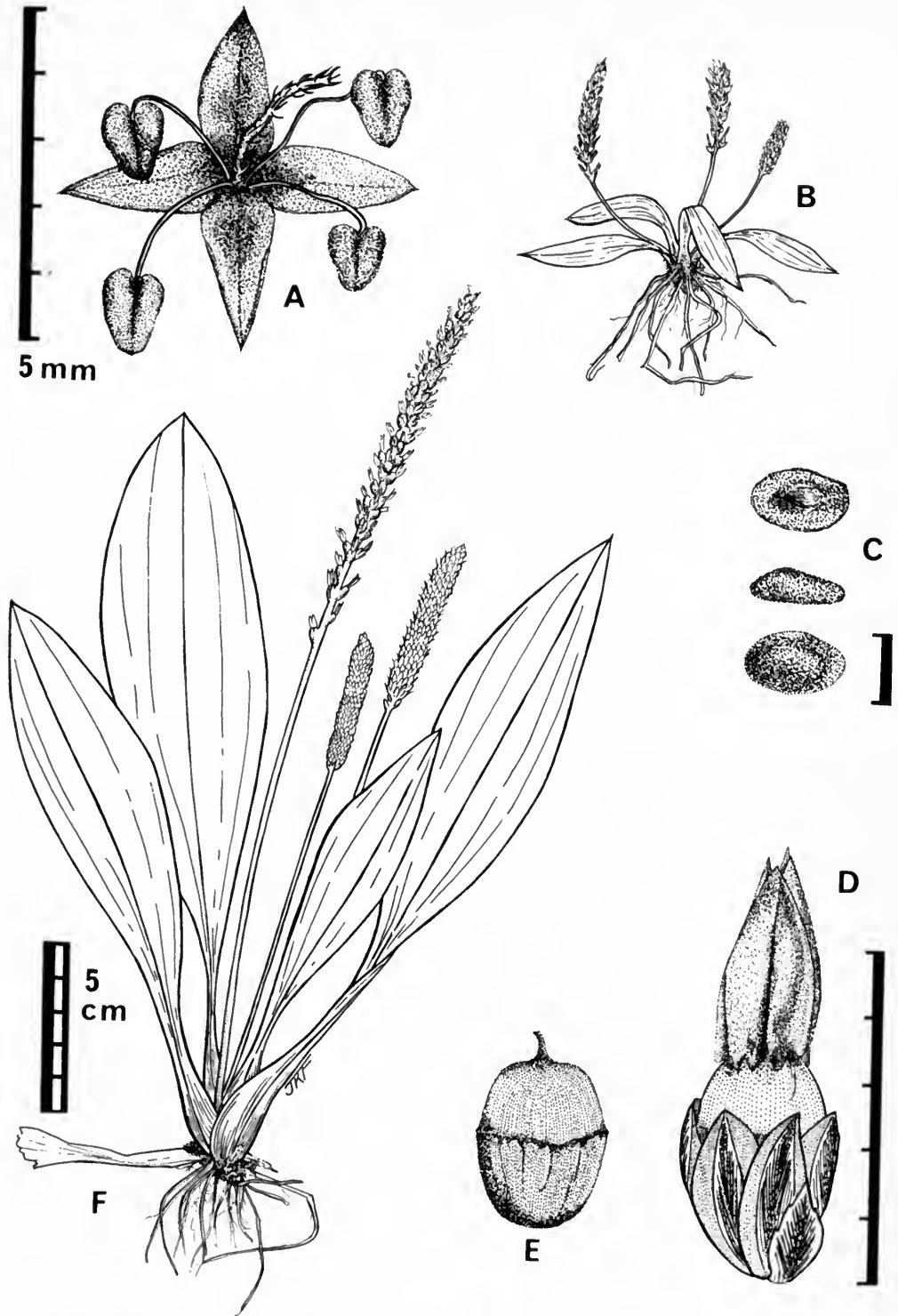


FIG. 19. Plantaginaceae: *Plantago australis*. A, Flower viewed from above; B, a small plant; C, seeds (1-mm scale); D, fruit with bracts and perianth (5-mm scale); E, fruit (same scale as D); F, a large plant.

**Plantago lanceolata** L., Sp. pl. 113. 1753.

**Herbs**, annual or becoming perennial, aerial stem very short with congested internodes, secondary roots numerous. Leaves erect or spreading laterally, petiole weakly differentiated from the lamina, clasping the stem at the base; lamina 4–28 cm long, 0.5–4 cm broad, lanceolate to oblong-lanceolate, entire or with small teeth along the margin, glabrous or puberulent, the veins usually strongly impressed above. Inflorescences 15–60 (80) cm long, peduncle longitudinally ridged, spike 1.5–8 cm long, bracts 2.3–5 mm long, triangular. Flowers with sepals 2.4–3.5 mm long, the 2 anterior (abaxial) sepals almost completely united, posterior sepals ovate, corolla-lobes 1.8–2.8 mm long, thin, translucent, reflexed; anthers ca. 1.8 mm long; ovary with only 2 ovules. Fruit ca. 5 mm long, not covered by the persisting corolla-lobes; seeds 2.3–3 mm long, inner face concave.

*Plantago lanceolata* has been reported on the slopes of Volcán Irazú and Volcán Turrialba (Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1264, 1938), but we have seen no specimens from Costa Rica or elsewhere in Central America. The species is now cosmopolitan and is naturalized in many parts of the Andes; it can be a troublesome weed of lawns and grassland.

**Plantago major** L., Sp. pl. 112. 1753.

**Herbs**, perennial from a short, thick rootstock, internodes tightly congested and hidden by the leaf-bases.

Leaves in basal rosettes, flat on the ground or erect, petioles 2–15 cm long, expanded at the base and clasping the stem; 10–30 (50) cm long 3–12 (18) cm broad, ovate to elliptic-ovate or broadly elliptic, obtuse at the apex, the larger laminae abruptly narrowed to the base and obtuse to truncate, margins entire or irregularly short-dentate, drying chartaceous, glabrous or with slender septicate translucent hairs 0.3–1 mm long, venation palmate with 3–7 (11) primary veins. Inflorescences spicate, 15–35 (50) cm long, flowering portion 4–28 cm long and 6–8 mm thick (dry), peduncle puberulent in early stages but becoming glabrous, flowers closely congested distally, bracts 2–3 mm long. Flowers with sepals 1.2–2 mm long, broadly ovate to obovate, with thin margins, glabrous or minutely puberulent along the midvein abaxially, corolla-lobes 0.5–1 mm long, narrowly triangular, obtuse or acute, rotate, not persisting as a covering on the fruit. Fruit 2–3.8 mm long, ovoid, usually with 5–many brown seeds; seeds ca. 1 mm long and 0.6 mm thick, variable in shape but mostly oblong.

A cosmopolitan weed of open sunny sites such as recently cleared land, roadsides, and stream edges. It is naturalized in the Central Highlands between 500 and 1500 m elevation and appears to flower throughout the year in Costa Rica. The plants have been used medicinally, fresh or ground as poultices; they are known by the name *Llantén*. The broad leaves and very short corolla-lobes are distinctive.

## Index

The index includes all accepted names (in Roman type), synonyms (*italics*), common English names (Roman), and vernacular names (*italics*). New species are in **boldface**, and the page numbers of illustrations are in **boldface**. Hyphenated words and multiple words are alphabetized by letter.

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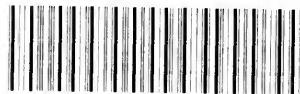




Families of seed plants known or expected to occur in Costa Rica and adjacent areas numbered according to the sequence of Engler's *Syllabus der Pflanzenfamilien*, edition 11, reworked by L. Diels (1936).

1 Cycadaceae	71 Nymphaeaceae	140 Quiinaceae
2 Taxaceae	72 Ceratophyllaceae	141 Theaceae
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28 Liliaceae	98 Oxalidaceae	167 Umbelliferae
29 Haemodoraceae	99 Geraniaceae	168 Cornaceae
30 Amaryllidaceae	100 Tropaeolaceae	169 Clethraceae
31 Velloziaceae	101 Linaceae, incl. Humiriaceae	170 Monotropaceae
32 Dicoreeaceae	102 Erythroxylaceae	171 Pyrolaceae
33 Iridaceae	103 Zygophyllaceae	172 Ericaceae
34 Musaceae	104 Rutaceae	173 Theophrastaceae
35 Zingiberaceae	105 Simarubaceae	174 Myrsinaceae
36 Cannaceae	106 Burseraceae	175 Primulaceae
37 Marantaceae	107 Meliaceae	176 Plumbaginaceae
38 Burmanniaceae	108 Malpighiaceae	177 Sapotaceae
39 Orchidaceae	109 Trigoniaceae	178 Ebenaceae
40 Casuarinaceae	110 Vochysiaceae	179 Symplocaceae
41 Piperaceae	111 Polygalaceae	180 Styracaceae
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45 Garryaceae	115 Buxaceae	184 Apocynaceae
46 Myricaceae	116 Coriariaceae	185 Asclepiadaceae
47 Juglandaceae	117 Anacardiaceae	186 Convolvulaceae
48 Batiidaeae	118 Cyrilliccae	187 Polemoniaceae
49 Betulaceae	119 Aquifoliaceae	188 Hydrophyllaccae
50 Fagaceae	120 Celastraceae	189 Boraginaceae
51 Ulmaceae	121 Hippocrateaceae	190 Verbenaceae
52 Moraceae	122 Staphyleaceae	191 Labiateae
53 Urticaceae	123 Icacinaceae	192 Solanaceae
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